THE USE OF COMPUTER AND COMMUNICATION SYSTEMS IN THE U.S. SENATE

HEARING

BEFORE THE

COMMITTEE ON RULES AND ADMINISTRATION UNITED STATES SENATE

NINETY-SEVENTH CONGRESS

SECOND SESSION

THE USE OF COMPUTER AND COMMUNICATION SYSTEMS IN THE U.S. SENATE

DECEMBER 8, 1982

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HEARING ON THE USE OF COMPUTER AND COMMUNICATION SYSTEMS IN THE U.S. SENATE

WEDNESDAY, DECEMBER 8, 1982

U.S. SENATE,
COMMITTEE ON RULES AND ADMINISTRATION,
Washington, D.C.

The committee met, pursuant to call, at 10:09 a.m., in room 301 of the Russell Senate Office Building, Hon. Charles McC. Mathias, Jr. (chairman) presiding.

Present: Senators Mathias and Hatfield.

Staff present: John B. Childers, staff director; William M. Cochrane, minority staff director; Gerald W. Siegel, minority chief counsel; John K. Swearingen, director, technical services; Ann B. Cook, chief clerk; Patrick B. Sarman, senior analyst; Peggy Parrish, professional staff member (minority).

OPENING STATEMENT OF HON. CHARLES McC. MATHIAS, JR., CHAIRMAN, COMMITTEE ON RULES AND ADMINISTRATION

The CHAIRMAN. The committee will come to order. I want to thank all of you for being here today for this hearing on computer and communications service and technology.

I have requested the leaders of the industry to advise the committee on formulating plans for computer and communications services to the Senate over the next several years. And I must say that the response of the industry has been extremely generous. Perhaps it is their perception of how great our need is that has evoked this response. We are grateful that so many are going to be here to testify, and we are grateful to others who have submitted thoughtful statements.

At present, the Senate seems to be well served at the level of current technology, at least to this extent: That every Senate office has access to large data bases in the Senate, in the Library of Congress, and at other critical points. The Members' Washington and State office terminals are connected via a private network to these data bases and to a large correspondence production service. And word processing services are also available.

Nevertheless, the committee recognizes—and if we didn't recognize it, we are from time to time reminded by other Members of the Senate—that technology is rapidly improving and advancing, so the committee wants to consider new and more productive services, and, to the extent that it is efficient and practical and economical to do so, to place those services directly into the hands of the user.

We will have several Members of the Senate testifying today on the computer service they would like to see added to the Senate operation. And, in fact, the Senator from Oregon, the chairman of the Senate Appropriations Committee, Mr. Hatfield, is due to start off.

These hearings are really designed to help the committee members make informed decisions on the course for computer service in the Senate for a period of the next 3 to 5 years. I think we need to make the kind of record which will help this committee make the decisions that are going to be critical. And it is only with the help that you can give us that we can make that kind of record. I say to you perfectly frankly that I am looking forward to it as a personal educational experience. As I don't have to remind my staff, I was an English major in college, and my knowledge of technology needs constantly to be advanced. And so I look forward today to that kind of a day.

Senator Hatfield?

Senator HATFIELD. Thank you, Mr. Chairman.

TESTIMONY OF HON. MARK O. HATFIELD, A SENATOR FROM THE STATE OF OREGON

Senator HATFIELD. Mr. Chairman, because of my keen interest in this subject, I did want to offer a few comments. Mr. Chairman, I believe a good case can be made for comparing my appearance before this committee to discuss computer technology with the fool who treads where angels fear to go. I am not an expert on computers, and I want to make that very clear.

But neither am I afraid of them, nor am I afraid of change.

Because of that naivete, I pioneered the use of computer technology in the Senate, as you know. From its inception, the correspondence management system, the CMS, has been in my office. At my urging, for 6 years, my staff has demanded more, better, and faster uses of CMS, and at every step of its development we have tried to offer constructive criticism while making creative suggestions and asking innumerable questions of the Senate Computer Center personnel. As a result of those efforts, today, in my office, we have a system that—one, can be accessed by all my office staff in both Washington, D.C., and in the State of Oregon; two, provides total text editing capabilities; three, enables me to write 1 letter to 1,000 Oregonians in a day, or a thousand different letters to 1,000 Oregonians 48 hours after their letter arrives in either my Washington or Oregon office; four, can print those responses in Washington or in the State of Oregon; five, keeps tabs on everyone to whom I have ever written; six, sorts those letters into any category by which I want to keep them; seven, updates my mailing list automatically; eight, permits my speeches to be typed and corrected ad infinitum and to insert them into any text that may exist in my correspondence files; nine, that enables me create texts such as this very statement on a lap-held terminal at home, and to automatically place that text into the same correspondence system for production this morning on a CMS terminal; ten, is used to write and print my personal correspondence to friends and colleagues.

CMS introduced the Senate into the 20th century by applying computer technology to the various duties which we Senators face

on a day-to-day basis. But ironically we had barely entered the 20th-century technological scene before we discovered that the technology had moved already into the 21st century.

As our children have brought home their computer games, or have left home to play them, more and more Senators have become aware of the tremendous potential that computers offer for reducing and simplifying our workload and that of our staffs. With these developments, and the entrance into the Senate of individuals who had experience of computer technology elsewhere, the CMS system has become obsolete in the minds of many potential and actual users.

My primary reason for appearing before the committee today is to protect the Senate from throwing out the baby with the bath water in its eagerness to expand our computer capabilities. I am not here to defend the CMS program, since I have no particular stake in its survival or demise, but I do want to caution this committee about unwisely embracing a multitude of systems on the basis of misdirected complaints and frustrations.

Unfortunately, but perhaps understandably, it is said that the CMS program remains basically geared to the mass production of identical form letters. True enough, until last year. But for nearly a year my office has been pilot testing a full-screen editor in conjunction with the CMS system. After a few bumps and grinds, it has settled down to become a totally reliable and all-encompassing means of producing any unique text that I need, whether it be creating a letter, a speech, or a press release. In my office not one single letter or speech is typed on electric, magnetic, or electronic typewriters; every letter is produced on the keyboard of a computer terminal linked to the CMS system.

I mention this particular capability within my office to illustrate the fact that the computer system which we now have in the Senate is capable of an infinite variety of new applications. We are limited only by our imagination and our budgets.

Mr. Chairman, the U.S. Senate is a unique institution. On the one hand, we are similar to 100 separate small businesses with all the needs for computer technology of a typical small business; on the other hand, we represent 1 large institution whose needs for computer technology remain rather constant while the individual officeholders change constantly. We cannot plan for equipment acquisition on the basis of what one Member, who may be here today but gone tomorrow, may desire.

As the committee of the Senate charged with the administrative activities of this great institution, we must plan, purchase, and prepare for the common needs of the total body. In other words, how do we make the benefits of computer technology and application available to us whose primary interests and responsibilities are not in the arena of information processing?

I suggest that we continue to depend upon a centralized support group to assist individual Senators and their staffs in the acquisition, application, and maintenance of such systems, without hampering individuality or limiting flexibility in the needs or desires for computer programs and hardware. We need technically qualified persons who are up to date on the state of the art in computer systems.

I must say to the committee that some of the correspondence systems being requested by our colleagues are clearly outdated and have their greatest appeal because many times they are the first such systems to which those Senators, or their staffs, have been exposed. My knowledge of these things is equally elementary. And that is just my point. Frankly, I wouldn't know if I was being sold a pig in a poke or the most advanced computer system on the market, given the slickness of some of the marketing techniques that are used. And we shouldn't have to know the difference, as Senators. What is important is my ability, and the ability of my staff, to articulate our needs and the limitations of our current machinery and systems.

To belabor this point a moment longer, I think it would be instructive to the committee to remember the period of time when railroads were first being built in this country. The "iron horse" was a new invention and no two were alike. Moreover, no two could run on each other's track until a degree of standardization was achieved. We are facing the same lack of standardization in the computer world today. Although the problem is being addressed, we still face the dilemma of purchasing equipment or programs that are not interactive, that can't run on each other's tracks.

Every Senator who is seeking to enlarge his or her computer capabilities is looking forward to the day when a whole series of tasks can be performed on a central office computer system that can be accessed by any staff member using desk-top terminals.

But such integration of functions will not be possible unless Senators do in-depth research on the system that they acquire or are able to see into the future. Since we are not prepared to do either, as Senators, we must continue to turn this task over to the professionals serving this committee and to those in the Senate Computer Center.

For this reason, I am delighted that you initiated this hearing, Mr. Chairman. I am afraid that the times caught up with us on this committee and we were caught with our pants down. As a result, we now have a number of innovative Senators asking for more, better, faster equipment, just as I did 6 years ago. We have not kept pace with technology. We need to demand more of ourselves and our technical staff in terms of innovation and responses to need. I do not intend to stand in the way of any Senator who wants to modernize his or her office operation; I want us to be on the right train, however.

The Senate Computer Center has undertaken to deal with these problems in its development of a system to replace the CMS program. An extensive review of user requirements was undertaken in 1981 and a final request for proposal [RFP], is nearing completion. The new system has been described in functional terms and, as such, is open to any approach that vendors may care to propose in meeting Senate requirements, be they time-sharing, centralized, in-house or distributed approaches. This is the best means of conducting a test to determine the most viable approach in the Senate environment. We will be putting out our specifications and receiving proposals addressing all possible approaches.

Upon evaluation, much of which should be cost oriented and done by qualified professionals, we will be able to choose the approach that best meets our needs.

I know that some of our colleagues have grown tired of having this future system, known as OASIS, offered in lieu of our present reality, and I sympathize with their frustrations. We have moved too slowly in producing the OASIS RFP and in augmenting the equipment of the current system, as well as its program capabilities. I trust we will be moving on the advertisement of the OASIS in the very near future.

In the meantime, the Rules Committee should be moving full steam ahead on the permanent installation of sufficient screen editor terminals to permit Senate-wide use of the text-editing system that has been piloted in my office, and I believe, in at least one other office. I have asked the Computer Center for information on means of implementing this function and have received a preliminary response indicating that existing terminals, incapable of any internal microprocessing operations, could be replaced with 450 full-screen editors for use in text editing, and that those machines are available to the Senate right now. The full-screen editing capability within CMS provides the best of both worlds, allowing personalized responses to be generated through the system and taking full advantage of the automatic mailing and filing capabilities offered through the comprehensive correspondence system.

What is our future? I see terminals at the desk of every Senate staff member, electronic mail communication within each office, linkages between agencies and the Congress to eliminate the costly flow of paper in the Government. One day soon we will link television and voice communications with our computer systems and break through that frontier.

Our committee, this Rules Committee, will have to prepare for that future.

Thank you, Mr. Chairman, for your graciousness in allowing me to speak to the committee.

[The prepared statement of Senator Hatfield follows:]

PREPARED STATEMENT OF HON. MARK O. HATFIELD, A U.S. SENATOR FROM THE STATE OF OREGON

Mr. Chairman, a good case could be made for comparing my appearance before this committee to discuss computer technology with the fool who treads where angels fear to go. I am not an expert on computers; but neither am I afraid of them or of change. Because of that naivete, I pioneered the use of computer technology in the Senate. From its inception the correspondence management systems has been in my office. At my urging, for six years my staff has demanded more, better, and faster uses of the system. And at every step of its development we have tried to offer constructive criticism, while making creative suggestions and asking innumerable questions of the Senate computer center personnel.

As a result of those efforts, today in my office is a system:

That can be accessed by all my office staff in both Washington, D.C. and in Oregon,

That provides total text editing capabilities,

That enables me to write one letter to one thousand Oregonians in a day, or a thousand different letters to one thousand Oregonians 48 hours after their letters arrive in either my Washington or Oregon offices,

That can print those responses in Washington or Oregon,

That keeps tabs on everyone to whom I've written,

That sorts those letters into any category in which I want to keep them,

That updates my mailing list automatically,

That permits my speeches to be typed and corrected ad infinitum and to insert into them any text that may exist in my correspondence files,

That enables me to create text such as this very statement on a lap-held terminal at home, and to automatically place that text into the same correspondence system for production this morning on a C.M.S. terminal,

And that also is used to write and print my personal correspondence to friends and colleagues.

C.M.S. system introduced the U.S. Senate to the twentieth century by applying computer technology to the various duties which we Senators face. But, ironically, we barely entered the twentieth century technological scene before we discovered that the technology had moved already into the twenty-first century. As our children have brought home their computer games—or have left home to play them—more and more Senators have become aware of the tremendous potential that computers offer for reducing and simplifying our workload and that of our staffs.

With these developments, and the entrance into the Senate of individuals who had experience with computer technology elsewhere, the C.M.S. system has become obsolete in the minds of many potential and actual users. My primary reason for appearing before the committee today is to protect the Senate from throwing out the baby with the bathwater in its eagerness to expand our computer capabilities. I am not here to defend the C.M.S. program since I have no particular stake in its survival or demise. But I do want to caution this committee about unwisely embracing a multitude of systems on the basis of misdirected complaints and frustrations.

Unfortunately, but perhaps understandably, it is said that the C.M.S. program remains basically geared to the mass production of identical form letters. True enough until last year. But for nearly a year my office has been pilot testing a full-screen editor in conjunction with the C.M.S. system. After a few bumps and grinds, it settled down to become a totally reliable and all-emcompassing means of producing any unique text that I need, whether it be creating a letter, a speech or a press release. In my office not one single letter or speech is typed on electric, magnetic or electronic typewriters—every letter is produced on the keyboard of a computer terminal linked to the C.M.S. system.

I have mentioned this particular capability within my office to illustrate the fact that the computer system which we now have in the Senate is capable of an infinite variety of new applications. We are limited only by our imagination—and our budgets.

Mr. Chairman, the United States Senate is a unique institution. On the one hand we are similar to 100 separate small businesses with all the needs for computer technology of a typical small business. On the other hand, we represent one large institution, whose needs for computer technology remain rather constant while the individual officeholders change constantly. We cannot plan for equipment acquisition of the basis of what one Member, who may be here today, but gone tomorrow, may desire. As the Committee of the Senate charged with the administrative activities of this great institution, we must plan, purchase and prepare for the common needs of the total body. In other words, how do we make the benefits of computer technology and applications available to persons whose primary interests and responsibilities are not in the area of information processing?

I suggest that we continue to depend upon a centralized support group to assist individual Senators and their staffs in the acquisition, application and maintenance of such systems. Without hampering individuality in needs or desires for computer programs and hardware, we need technically qualified persons who are up-to-date on the state-of-the-art in computer systems.

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To belabor this point a moment longer, I think it would be instructive to the committee to remember the period of time when railroads were first being built in this country. The "Iron Horse" was a new invention and no two were alike. Moreover, no two could run on each other's track until a degree of standardization was acheived. We are facing the same lack of standardization in the computer world today. Although the problem is being addressed, we still face the dilemma of purchasing equipment of programs that are not interactive—that can't run on each

other's tracks. Every Senator who is seeking to enlarge his or her computer capabilities is looking forward to the day when a whole series of tasks can be performed on a central office computer system that can be accessed by any staff member using desktop terminals. But such integration of functions will not be possible unless Senators do in-depth research or are able to see into the future. Since we are not perpared to do either, we must continue to turn this task over to the professionals serving this committee and to those in the Senate Computer Center.

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What is our future? I see terminals at the desk of every Senate staff member; electronic mail communication within each office; linkages between agencies and the Congress to eliminate the costly flow of paper in the Government. One day soon we will link television and voice communications with our computer systems and break through that frontier.

Our committee will have to prepare for the future.

Thank you, Mr. Chairman, for your graciousness in allowing me to speak to the committee.

The CHAIRMAN. Thank you, Senator Hatfield. Our first witness will be Mr. Kenneth H. Olsen, president and chief executive officer of Digital Equipment Corp.

As you are taking your place, Mr. Olsen, I should announce that the ranking minority member of this committee, Senator Ford of Kentucky, will be joining us shortly. He is in another committee meeting at this hour, but he has asked us to place an opening statement in the record, which I will do at this point.

[The following was received for the record:]

STATEMENT OF HON. WENDELL H. FORD, A U.S. SENATOR FROM THE STATE OF KENTUCKY

Mr. Chairman: Before this hearing of expert witnesses begins, I would like to make a brief statement. I think what we are doing is tremendously important. Tech-

nology in computer data processing has advanced so rapidly that it is difficult for us to plan effectively and efficiently for the Senate.

Electronic data processing has been available to the Senator for little more than a dozen years. In this time, the Rules Committee, assisted by the Secretary and Sergeant at Arms of the Senate, the Library of Congress, the General Accounting Office, and other experts in and out of government, has tried to develop policies and plans for the orderly and cost-effective deployment of computer and data-handling equipment. The task has been complex and difficult.

It is important for us to be sure that every legitimate need of Members and committees is met, if doing so does not involve excessive cost. It is equally important that in meeting these needs, we do not act at such time that we lock ourselves into obsolescent equipment and methods just as newer processes appear on the horizon. Knowing when to lease or buy is not easy. We and our staff need and welcome all the expert advice we can get.

At substantial cost, we have already put in place equipment and procedures that provide a multitude of services to Members and committees, correspondence, records management, information retrieval, mail files and other historical indexes, electronic printing, text processing for statements, reports and speeches, and a variety of budget and economic analytical aids are among these services.

I have requested and been furnished some financial data which gives a general picture of the cost magnitude of our past and present efforts in this computer field. for the equipment the Senate has purchased, and which is still in use, the original purchase cost totals $8½ million. For rental of equipment currently in use, not including the service charges for our correspondence management system, our annual payment is $3.7 million. All annual cost related to the Senate computer operation are, for fiscal year 1983, approximately $17 million, not including amortization charges for purchased equipment.

With new development coming more rapidly and in greater number, it is timely that we stop now and take a look at the entire scope of these technologies and services. The examination we make must be as comprehensive and precise as possible. Our goal is a collection of decisions which selects the best equipment and processes to provide for all, but not more than, the needs of the Senate, and at cost-efficient expenditures.

Achieving this balance in our goals will be very difficult. I want to express my deep gratitude to all those here who are going to help us in this important endeavor.

TESTIMONY OF KENNETH H. OLSEN, PRESIDENT AND CHIEF EXECUTIVE OFFICER, DIGITAL EQUIPMENT CORP.

Mr. OLSEN. Thank you, Mr. Chairman. My name is Ken Olsen; I am president of Digital Equipment Corp. We appreciate the opportunity to discuss this with you. I would like to summarize my formal statement, and ask that the full text be inserted in the record.

Being the first one today I think it falls on me to explain what this is all about, at least from my particular point of view.

For many years I fought against using the words "office automation" because they intimidate people; they imply many things which aren't valid at all.

The CHAIRMAN. Can I interrupt you to say that that word "intimidation" is a very good word, and I think that is part of our problem around here in the Senate. People say we are going to put a computer in your office, and, all of a sudden, you are intimidated—what do you do with it, how do you work it, what does it do?

Mr. OLSEN. I may not do a good job in explaining it, because we take so many aspects of the technology for granted, that by now I may not be able to distinguish the "novel" from the familiar. But let me try, and then you interrupt and ask me anything you would like.

"Word processing" is another set of words that intimidates, of course, because they are just unfamiliar. But let me give an illustration.

In my office a few years ago, now quite a few years ago, if I had a number of memorandums to send to a number of people, I would bring in the dictating machine in the morning, my secretary would type the memos out; she would retype them, to correct the obvious things that I had mumbled or made mistakes in, hand them to me to go over once more. Then she would retype them, spend a long period of time at the copying machine making copies, spend a long period of time typing envelopes, and then put them in the mail.

And even within the one town in which we are located, it would often take 2 days to get the memos delivered. With the electronic word processing and electronic mail, if I come in with six notes in the morning and give her the dictation tape, she types it just once. It's on the video screen, and she edits it and corrects it there. If there is something that I mumbled too badly for her to straighten out, or something quite illogical, or a strange word, she will pass a note to me or ask me, and, as soon as it is correct, she can instantly mail it to any part of the world. We have within the company 8,000 subscribers to our electronic mail system.

So if I sent 6 memos to 14 vice presidents, they could readily be on their desks at 8:30 in the morning. You can see some problems with this such as the temptation to overutilize the system, but having the correspondence there, delivered, on the same day as compared to 2 days later, as it was a few years ago, well, you can see the enormous advantages.

Secretaries in the Boston area have been concerned about the lack of satisfaction in their jobs. Sometimes the concern comes about because of—such things as making coffee; but I believe it's often really because of the long period of time they spend typing, copying, addressing envelopes—retyping, typing, and retyping. It is truly satisfying to a secretary, by 8:30 or 9 in the morning, to get 14 copies of 6 notes out all over the world.

Here's another illustration: The written testimony for this hearing was delivered to your staff last Friday. If I remember correctly, it was first written in Washington on Wednesday evening, edited in New Hampshire, grossly redone on Thursday by myself, sent back to New Hampshire, where it was corrected so it flowed correctly, and printed here in Washington. My part took place on Thursday; it immediately went electronically to New Hampshire and it immediately went to Washington, and I think was delivered Friday afternoon.

We take this so for granted, that I never even thought of mentioning it till it was pointed out to me.

This is what electronics means to us in an office.

I've mentioned that Digital has an electronic mail system, with 8,000 terminals; many of these are duplicated in our employee's homes, so that at home they can empty their "mailboxes." They have a choice of emptying it and electronicially "throwing away" the contents; or emptying it so they can preview it and in the morning their secretary can do what she should do with it. They can enter memos at any time. Our vice president of engineering

gets ideas in the middle of the night, and he will type them out at 3 in the morning, then be able to sleep. When his memos don't——

The CHAIRMAN. That is something I haven't tried yet. [Laughter.]

Mr. OLSEN. When his memos don't seem quite reasonable, we look at the time at which he typed them; if it's 3 in the morning, we understand that he wasn't quite awake.

But you can see how the flow of information is fast and easy.

Where is the institutional benefit of the technology?

We do not argue for cost saving; it can be there, it may be there. The main argument for use of electronics in the office is that it makes better use of the time of those people who you can't duplicate or have more of.

And so the argument is: To make things easy.

At Digital, we don't normally have typewriters in the office. I saw one secretary a few days ago standing on her tiptoes typing on a typewriter on top of a file cabinet. It was used so rarely that being on top of a file cabinet was good enough. And things get typed usually only once.

You said many things, Senator Hatfield, that I was going to say. But I would like to pursue your railroad analogy, which is really very good. The laws and regulations governing the railroads standardized on the track, gage, standardized on the coupling and the signals; this gave a lot of freedom to the individual railroads, and a lot of good came as a result. And I would suggest that you would want to maintain exactly that analogy, because you don't want to force any one Senator to do things the way you do, or be in a postion to force you to do things the way they do them.

I personally don't use a terminal; I once printed my electronic mail at home and got 25 yards of mail—that is the last time I did it. I've let the secretaries do it from then on. Some people will do it that way and some will use it personally.

The important thing is, many activities have to be done centrally, as with the railroad, in order to have them accomplish the things that you outlined. The interchange of electronic mail has to be planned and done centrally; but with what's done individually, you can tolerate large amounts of freedom.

Our first experience with electronic mail—it may be the world's first experience—came with the DOD ARPA network, which started in the late sixties. That network now has thousands of users in the academic world, the military of course, and I think 160 industrial companies are involved in it. We have been close to it—they are mostly our computers—although not universally. They have a mixture of terminal computers and terminals of all kinds, and I think that is a good model for a system. There is free communications throughout this country and those parts of the world in that network. And it accomplishes all of the things that you in the Senate ask for, and has done wonders in science, the military, and in the academic world.

The detailed features that one would want are something that takes discussion. There is electronic filing. I have no paper files. I request that all memos just be printed again, because it is all filed electronically. Now, many features like this you may want to change.

The White House has our system for their word processing and electronic mail. One of the features we normally sell is a calendar; if you want to have a meeting, the computer looks at people's calendars and finds an opening which is free for everyone and says "that is when the meeting is." This was modified at the White House, because when President Reagan wants a meeting, everybody else's calendar gets changed. But there is freedom—the beauty of computers is their freedom.

The main point I would like to leave you with is the need for discussing these things in a way which makes them a help to the staff and the manager and the Senator. The technology should make the individual's life more efficient, less frustrating, with much more free interchange of information, so everyone is more knowledgeable without the effort traditionally required—and more satisfying to everyone involved.

And in these terms I think the whole project is one which will be received with open arms and one which will not have any negative reaction. Once it is used, as you well have pointed out, you can never go backward. It is the greatest thing for preachers, lecturers, politicians—speech givers. And for those who are getting a little older, the speech can be typed two or three times the normal size.

And the frustrating thing for most speakers is, after they lay out an outline, retyping it. That, of course, is done all automatically.

So it's all positive, and that is, I think, my main point.

We have been involved in the very early word processing, starting about 1960. A bit of history: Word processing, we believe, came from computer programing. Systems created to edit programs in 1960 were used to write letters. We called it then an expensive typewriter. And it grew from that.

The electronic mail came from ARPA. Their "merger" is office automation.

We have installed more than 1 million terminals throughout the world, doing electronic mail and word processing, probably by far the largest numbers. The academic world, the military, the scientific community are all using our computers. Many of Digital's computers have word processing and electronic mail capabilities. This has just overtaken the outside world. I think most of the academic theses are probably done with our terminals.

The whole newspaper industry has changed. It used to be mechanical, with people running around with sheets of paper; now the industry is completely different—just in the last 10 or 15 years—where the same new functions which we discussed have been adopted by the newspapers. A story is typed once on a screen, edited, automatically set in type, justified, all the things that used to be done mechanically; it is the office automation functions which have changed that industry. And we like to think we played a key part in that. It is to the point where we are withdrawing from it because there are no more newspapers to automate.

And our enthusiasm is still as great as ever because there are so many more things to be done in the world.

With that, I would be happy to answer any questions.

The CHAIRMAN. Do you have any questions, Senator Hatfield?

Senator HATFIELD. No, Mr. Chairman.

The CHAIRMAN. Senator Hatfield's experience in this whole area is much longer and deeper than mine, and I value his statement here this morning, which I think reflects not only his personal experience, but also what he hears from other Members of the Senate. So it is of particular value.

One of the things, Mr. Olsen, that you said in your statement was that you thought it was feasible to have systems designed from components from several vendors. Now, from our point of view, and from the committee point of view in trying to manage this in some intelligent way, we have some concern about multivendor systems and with establishing standards that are applicable to all components of that kind of system.

Mr. OLSEN. There have to be certain standards well thought out ahead of time, so the individual elements of a system can communicate freely. But even though we would like to sell it all, of course, because we think we do the best job, standards all the way limit growth and development.

The CHAIRMAN. Standards, now, in what areas, to be a little specific?

Mr. OLSEN. If you standardize one system so everyone must use the same thing, without exception, you then limit the freedom to accommodate new technology which will improve things. If you pick one system, most Senators would choose that one, but the improvements, the developments, the future growth is going to come about with a maverick who wants to do something different.

Now, for example, I don't think you want a full-page screen—most people we work with we think have full screen. But that is a question that is unimportant; a full screen, a half a screen; that's not a major issue. Some people want the little bug that goes around, goes one way and some want to go a different way, and it may not be worth changing. You want to give people the freedom; you see, if two people feel differently, that's unimportant.

They have to be able to communicate with each other. You can't compromise on that. That is where the issue of standards is crucial—assuring that the different components of a system can "talk" to each other. Industry is actively working at that through the voluntary standards process.

The CHAIRMAN. There has to be that basic compatibility?

Mr. OLSEN. There has to be the basic compatibility, yes. And Congress should support industry's efforts in the voluntary standards area, particularly by encouraging Federal agencies to participate in and support the industry process.

The CHAIRMAN. What about vendor support of the systems if you have different components?

Mr. OLSEN. Oh, now, from that point of view there are things you have to do: training, maintenance, for example. That's a business decision which the administrative people have to be careful to make, to be sure that they get good support for everything. It's a major issue. The significance of reliability cannot be underestimated, especially if you become dependent on the technology. With a newspaper printed on a computer, the publisher must have it every afternoon. When the Senate becomes dependent on a computer system, service and reliability are of utmost importance, and that's a business decision that has to be worked out in selecting a vendor.

The CHAIRMAN. What about training? If you have several vendors, do you have to bring your staff together with three or four different groups rather than just one group, one vendor?

Mr. OLSEN. Oh, there is a list of disadvantages to having more than one vendor, and you have to weigh that. Each one should be able to retrain in the various distinctions. Then there are opportunities for the self-training as well as class training and individual training. These are all factors in picking an individual system and vendor.

The CHAIRMAN. All right.

In your testimony just now you were describing how you could put together memorandums and correspondence, and you said the cost factor wasn't the overriding basis of decision.

How do you evaluate costs and benefits of automation technology in offices like Senate offices?

Mr. OLSEN. We believe the advantages are there, but we can't figure out how to quantify them, because your assumption——

The CHAIRMAN. We have got 225 million people that are paying the bill here; we have to justify it somehow. I don't know that I can use your testimony in that sense. [Laughter.]

Mr. OLSEN. You are only allowed two Senators in each State, and you just can't reproduce them, and you have to use their time or some of these——

The CHAIRMAN. Some people wouldn't want to. [Laughter.]

Mr. OLSEN. And it's almost worth any price if you can use their time more valuably, if you can just be more efficient and more relaxed, you know, and——

The CHAIRMAN. More thoughtful, hopefully?

Mr. OLSEN. More thoughtful. And that's really the payoff, and that's the payoff in business. The technology brings improvements in efficiency and in individual effectiveness.

The CHAIRMAN. Do we take any risks? Do you see where, as we increase automation in Senate offices, there are risks? Is this whole technology developed to a point that it is a settled and established business practice, or are we still a sort of research and development project?

Mr. OLSEN. There are always risks, and you have to pick the right vendors and make the right decisions. But the technology is proven. It's been going for many years now. Anything the Senate would acquire would not be a laboratory prototype. And there are other risks in usage. If it takes 2 days to get something or if you want it immediately and you have to send somebody to deliver it, the correspondence is low or the telephone calls are high. If you have fast communications, you may end up with a lot more notes being sent, and this can sometimes be wasteful. In general, I think that they are far outweighed by the positive benefits.

The CHAIRMAN. Now, going back to the previous answer on the question of how do you calculate the benefits: You emphasize efficiency and effectiveness in office automation systems. How would you measure effectiveness?

Mr. OLSEN. Oh, I think there's no comparison between what you can do with a system, as opposed to not having one. If you can get information and it's easy, if you can take care of an issue, a letter or something easily, it's just——

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The CHAIRMAN. If you can do what Senator Hatfield said—alternatively write a single letter to 1,000 constituents or 1,000 individual letters—and you can do it sitting in Washington and have them typed in either Oregon or Washington, would you say that's an effective——

Mr. OLSEN. You may argue the question that he should send it to 1,000, but——

The CHAIRMAN. Well, that's his decision.

Mr. OLSEN. That's his decision. But once you assume that, every aspect of sending those 1,000 letters is just so much easier.

At one time I was getting 200 job applications addressed to me—all my classmates, they said—and 200 requests for contributions. Now, that's urgent, you see. With only three secretaries—I obviously am not in my office long enough to do that. Now, the secretaries take care of that quickly and easily with the computer. And when someone calls up and asks "what happened to that letter?" As he's talking to the secretary, she strolls to the tube, immediately finds out what she did with the letter, and she can tell the person before he finishes talking what happened to that letter and who was taking care of it. And I believe just her pride and satisfaction are worth all of the costly equipment, which permits her to handle it so nicely as far as the one calling is concerned. And it is this kind of thing which just makes the office a pleasant place to be.

The CHAIRMAN. Do you have any questions, Senator?

Senator HATFIELD. Mr. Chairman, I would just like to make one further observation.

Mr. Olsen, you were talking about these letters, the correspondence you received.

Do you have a storage system in terms of quick reference to those letters that you sent out so that you could pick them back out and initiate a correspondence later?

Mr. OLSEN. The letters I have—that I write, the internal letters and notes I gather are filed electronically. The letters I get from the outside are filed electronically just by a title.

Senator HATFIELD. You know, one unique factor in our particular job is that traditionally, historically, we only have reacted. We have been in a role of trying to expeditiously respond when a constituent writes to us. I am 3,000 miles from my constituency, and frequently constituents will write all members of the delegation to see which one is going to answer first, the same letter, the same request.

One of the great problems we face in the country today, in my opinion, is the feeling of disconnectedness between the citizen and the Government, and that gap, that failure to bridge it. What we have found to be very effective is this: When a person writes to me about a social security question; all right, I respond to that question, we store that. Six months later we have taken some action that affects social security. I now pull out the names of all of those people who have written to me on that subject, initiate a response, saying, "you wrote me recently about this, and there has been this modification on which I would like to update you." That has given us the opportunity to be more than just reactive in a relationship with a constituent; also it tends to bridge the gap, the feeling of disconnectedness. To me, that is, from our standpoint, a very fun-

damental part of being able to serve a constituent. I feel, well, that's great political fallout; sure there is political fallout for that; the person says, my golly, he remembers the letter I wrote to him, now he is writing me about the same thing. But I think more importantly than any political fallout is the fact that it does provide us with a bridging relationship that I think is deeply in the fibers within our society.

Would you care to comment on that facet of being able to store information and utilize it again in an initiative role rather than a reactive role?

Mr. OLSEN. Yes. That's one of the things you can do. And I think it is just one more example of the way in which computing technology can make us more human instead of less human.

Senator HATFIELD. You think of technology oftentimes as dehumanizing a relationship, whereas in this situation, I think we can really infuse a human element in the so-called history of technology.

Mr. OLSEN. Senator, you asked if there is any danger. There is one danger which a staff should be very conscious of and that is the ever-present security problem. Now, most of the correspondence you have is of no great sensitivity, but security is something that should always be kept in front of people: security costs money; security has complexity and redtape; and when you need it, it is going to cost more. It shouldn't be used when you don't need it, but it should be considered as part of the system.

The CHAIRMAN. Well, thank you very much, Mr. Olsen. We appreciate very much your being here and starting off these hearings.

[The prepared statement of Mr. Olsen follows:]

PREPARED STATEMENT OF MR. KENNETH H. OLSEN, PRESIDENT, DIGITAL EQUIPMENT CORP.

Mr. Chairman, members of the committee, my name is Kenneth H. Olsen. I am President of Digital Equipment Corporation. I am pleased to have this opportunity to provide the Senate with our views on how technology is making office work more efficient, more pleasant, and more satisfying. I would like to outline what the implications of this are to the U.S. Senate.

Digital, founded in 1957, is the second largest computer company in the world, with sales in Fiscal Year 1982 of nearly $4 billion, sixty-seven thousand employees worldwide, exclusively engaged in the design, manufacture, sale and service of computers and related software. Digital has supplied more computers to the U.S. government than any other company.

First, I would like to tell you about what office automation means to me personally in my own office as an example of modern technology. Then I will tell you a little about experiences of other organizations. Finally, I want to say what office automation might do for the Senate.

Several years ago when I came to work in the morning, there were several notes I had dictated the night before, and my secretary would type them out, then re-type them as she edited. Then, she would let me look them over, and when they were O.K., she would re-type them again. She would then make all the copies that I had requested, address the envelopes and put them in the mail. If there were a number of notes addressed to a large number of people, it would take a good part of the morning. It was a very unsatisfying job to her. In spite of the money we paid for internal mail, it usually took two, sometimes even three days, for the receiver to get my notes. Often, I would not bother sending notes at all because of the delay, and because of the tedious nature of the secretarial work.

Today, and for the last several years, we use word processing and electronic mail. When I come in with a half dozen notes addressed to 14 people, my secretary types them out on her screen and edits it there. If the messages look clean to her, she pushes a button and it immediately go to all 14 recipients anywhere in the world.

We now have 8,000 terminals around all our facilities in the world, and it is not uncommon to have my memos delivered by 8:30 in the morning. You can see, there is no loss of job satisfaction in getting this much work done by 8:30; in fact, it is most satisfying to a secretary.

There are indeed extra memos written because it is so easy and so efficient. Sometimes, a memo is answered, re-answered and re-answered again, all in the same day, by using electronic mail. Before, with the delays, many never got answered at all. The savings in telephone calls overwhelms any cost increases due to electronic mail.

It is hard to measure efficiency and cost-saving in an operation such as ours, but the satisfaction of being able to communicate quickly, easily, and positively is very satisfying. In fact, it is hard to conceive of business life without this capability. I am afraid, I would lose my secretaries if we ever eliminated this system.

Digital started in 1957 with a few of us from M.I.T. who had the idea of introducing interactive computing to the industrial and scientific market at a time when computing was very remote, very distant and very formal. People at that time brought their problems to a computer in the form of a stack of punched cards and waited a day to get the answer, and the answer usually was that they had made a mistake. In interactive computing, the operator uses the computer to help introduce the problem, to develop the problem and to correct the mistakes. Both the program and the operator learn as the interactive computing progresses. In time, we, with the help of our customers, developed time-sharing which allowed a number of users to interact with the computer at the same time. Later on, we introduced distributed processing where many smaller computers are used in a network either to work together on a single problem or to work separately and share data bases.

Very early in our development, word processing was introduced. This was done on our first computer, the PDP-1, in the early 60's. The goal was not to reproduce the same letter to many people but to use all the power of the computer to make writing and editing easier, and to allow the creativity of the individual to be fully used.

For a long time, we refused to the use the words "office automation" because to some it implied doing mechanical jobs that human beings performed. This technology, infact, helps individuals do the things they do best, and takes care of the dull chores of reproduction and memory and distribution that are not creative and not satisfying. It frees people to be creative and productive. It makes their work more enjoyable.

The other import function included under office automation is electronic mail. We started this with the Department of Defense ARPANET (Advanced Research Projects Agency Network) in about 1969. From that beginning, grew extensive use of electronic mail.

We now have over a million terminals connected to our computers doing office automation functions, word processing and electronic mail, in hundreds of academic, scientific, and industrial institutions. The newspaper industry is one of the most exciting applications. About 20 years ago, we helped newspapers introduce world processing and editing on a computer combined with the use of electronic mail to distribute the text within the organization. The result has been a complete revolution of the industry. The newspaper plant is totally different today than it was just a few years ago. There is almost no hot metal, no linotype machine, and no old-fashioned printing presses. It is very quiet, pleasant, fast, efficient and reliable. The majority of the computers used in that industry to perform this revolution were made by our corporation.

The state of "distributed processing" has advanced dramatically in just two decades. It has been paced by smaller machines that work faster and cost less and by technology which provides for easy interconnection of many machines. These trends have been the result of something this nation can be very proud of—a highly competitive industry with strong entrepreneureal instincts and a lot of very good, very hard working engineers.

These advances have brought office personnel easy access to word processing, accounting, scheduling and electronic mail and other office capabilities at an affordable price. We define "office personnel" as encompassing not only the secretarial and support staff, but professionals, administrators, and managers as well. But more important is the fact that these capabilities are available to them in a user-friendly way. Said another way, the power of easy to use and inexpensive computers is now available to everyone.

In designing our systems we have also paid very close attention to making sure that the systems fit comfortably into the user's own work environment. Since systems will be used by professionals who access them many hours a day, workstations must incorporate comfortable keyboards and screens that tilt, swivel, and have

minimal glare. In essence, they should be easy and fun to use without being overly taxing.

The principal impact of the introduction of office automation is usually focused on productivity. Office productivity has two different dimensions. The first focuses on improving efficiency, "doing more work with the same resources". The second dimension focuses on improving effectiveness, or "doing a better job". We believe that it is essential for office systems to address both the efficiency and effectiveness of office personnel, to help get the right information, in the right form, to the right person, at the right time.

Many of the major corporations in the country and most of the major universities, use our computers for word processing or electronic mail, either as the major task of the computer, or as a side feature of a computer used for other purposes.

In Government, Digital systems are being used today by a Federal Agency to track correspondence and reduce the amount of time it takes to respond to a Congressional inquiry. The White House staff is using an electronic calendaring and scheduling system. The Federal Courts are using an electronic mail system to speed up the process of rendering judicial decisions. A DOD organization has automated the procurement and purchasing functions through the use of word processing. All of these are examples of how office automation systems are being used today to solve the very real informational needs of the Federal Government.

Problems in today's office are immense. We are told that, by the year 2000, 75 percent of all "work" will involve the handling of information. The current information explosion is burying all office personnel. I believe a major goal of office automation is to manage this explosion of information at all levels of office personnel, resulting in less time to produce, locate and distribute information and more time for creative activity.

As with any other innovation, the way in which office automation systems are introduced into the workplace will have strong implications for its usefulness. In today's information society where 50 percent of all jobs involve the handling of information, the ability to use these systems is important. But these must fit the workplace, not the other way around.

In order to make sure that the introduction of office automation can achieve its potential, it is important to understand something about the office. Digital has spent quite a bit of time trying to do this, and we've found some things we think are common to most office environments.

With our large number of employees requiring integrated computer and communication systems, Digital's development of its own internal systems have helped us understand that there are different levels of computing requirements within any organization: personal, departmental, and organizational, all linked through networking. We believe that today's office architecture is an integration of these different types of computing requirements.

The personal level comprises the individuals who make up an organization. At this level, office systems must help individuals do their job more efficiently and effectively. Typical applications may include office accounting, word processing, scheduling, electronic spreadsheet, and access to departmental systems. Above all, products at this level must be easy to use and easy to learn. They must be flexible, and adapt to the user's own environment. Since every worker and every office is different, we believe that you must be able to select the workstation that best fits the needs of the individual. In an integrated system these workstations do not simply stand alone; rather they all have to have the ability to also act as parts of larger systems, and transfer information back and forth.

The next level is Departmental. Departments are teams of people who share a common mission—like a Senator's office, or individual Sub-Committee. Systems at this level must enhance the way people work as a group, and make it easier for them to work together as a team. One example of a departmental level system is integrated office support. Our industry can today offer systems providing departmental users with an integrated office which includes word processing, electronic mail, calendar management, desk management, electronic filing, and information retrieval.

The final level is Organizational. Systems at this level must enhance inter-departmental communications and provide centralized capabilities available to the entire organization. One example of an organizational computing requirement is the access via a user's terminal to outside databases. For instance, access could be provided to the Library of Congress Data Base from the same terminal used for such functions as word processing or electronic mail. Access to services provided by the Senate Computer Center is another example. Finally, there are centralized services such as electronic mail. Within Digital, we use our own electronic mail system to communi-

cate across the organization. Although this is a centralized service, we have implemented it through multiple geographically separate computers, and we have over 8,000 subscribers on our system.

Now, I would like to address briefly the issue of communicating which is really the key to an effective organization. People use networks for communicating today. Visits, conferences, telephoning, and mail are all "networks" of sorts. They allow information to move from the person who has it to the person who needs it. One of the biggest advantages of office automation is the way it speeds up and simplifies this vital communication. Office automation networks can connect multiple people within a single Senate office. They can connect multiple people within a single Senate office. They can connect multiple Senate offices so that Senators and staffers can confer quickly on major issues. They can connect a Senator's Office with a Committee Office. They might also be required to connect a Senator's Washington office with the home office, or with other facilities such as the Senate Computer Center.

Obviously, effective office automation networks must complement and coexist with the networks that the Senate already has in place. Digital is committed to help solve the problem associates with multi-vendor networks. In particular, we are supporting industry and government standards for networking such as the X.25 protocol and the recently adopted IEEE Local area network standard, and will continue to try wherever feasible to develop products which conform to existing or planned standards. An example of how Digital addresses these organization needs is shown in the Appendix.

In some ways, the Senate is like many other large institutions—universities, banks, newspapers—where large amounts of information flow between many locations. On the other hand, some aspects of the Senate's structure make its needs very unique. The individual needs of 100 Senator's offices; the special demands of scheduling in multiple locations far into the future; volume communications between personal and committee offices, the Library of Congress, or the Office of Legislative Counsel. Although some needs may be unique, the solutions are commercially available today.

Office automation technology continues to move along at a rapid pace. Soon we will begin to see the widespread use of voice in electronic message systems and for voice editing of documents. Image transmission will also be used, and more extensive use will be made of teleconferencing techniques. New hardware developments will continue to provide more powerful and easy to use workstations that require even less space. The advantage of having a well-designed office architecture is that these new concepts can be implemented without disregarding what has already been installed. The industry is actively pursuing research in these and other ongoing office technologies so that we can continue to enhance our capabilities over time.

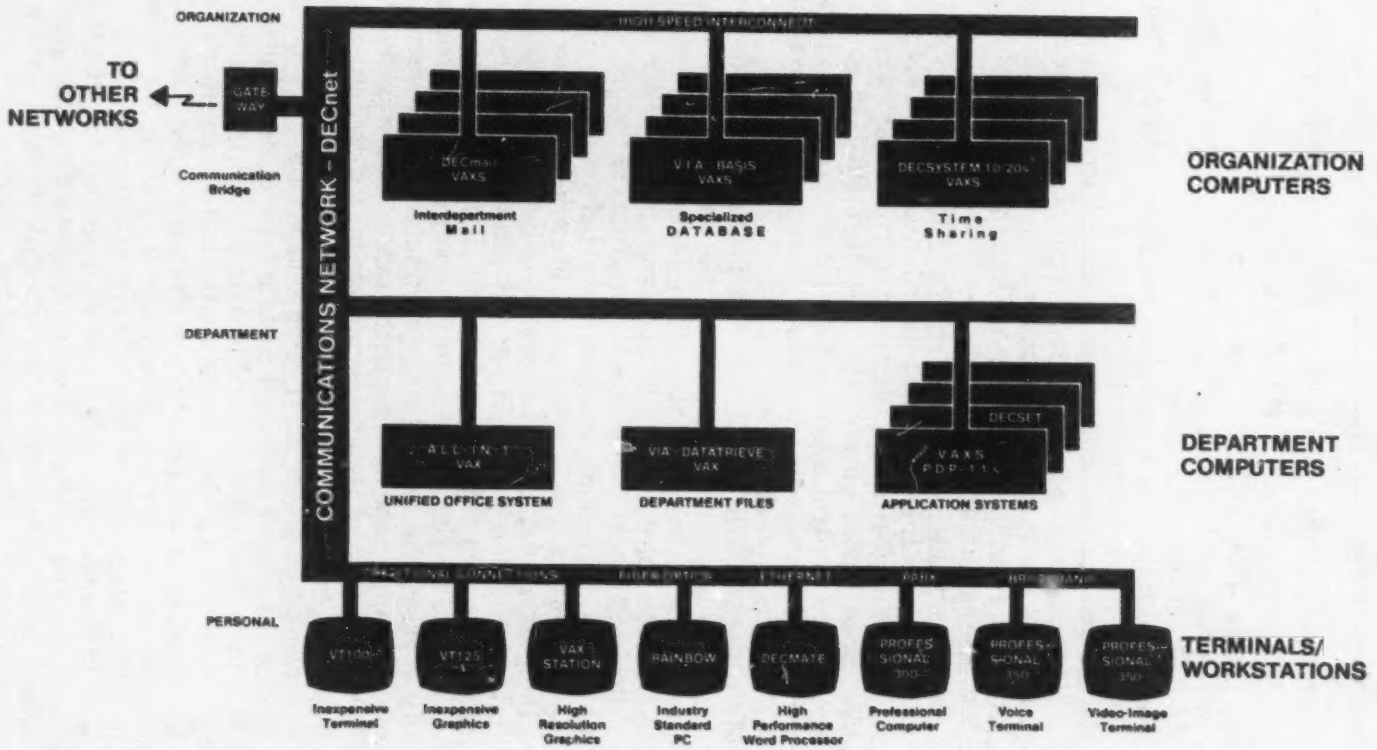
Ultimately, the decision by the Senate as to how to implement initiatives in office automation must be a weighing of institutional and societal concerns. As a public policy leader, the Senate can encourage the implementation of this important new technology, with its attendant benefits. As an institution, the Senate has the opportunity to acquire the many benefits of office automation for itself.

In its turn, industry has an obligation to provide the Senate with good information about its capabilities; to provide the Senate with good technology; and to support that technology once in place. Certainly that will be our effort.

DIGITAL EQUIPMENT CORPORATION

digital

OFFICE AUTOMATION DESIGN



The CHAIRMAN. The next witness is Mr. Jack C. Davis, who is senior vice president of Harris Corp.

TESTIMONY OF MR. JACK C. DAVIS, SENIOR VICE PRESIDENT, HARRIS CORP.

Mr. DAVIS. Thank you, Mr. Chairman.

I have with me today Bill Tolley from our corporation.

My name is Jack Davis——

The CHAIRMAN. We are glad to have you and Mr. Tolley, who is well known to the committee.

Mr. DAVIS. As you said, I am a senior vice president of Harris Corp. Harris Corp. produces high technology information processing and communications systems equipment, and we have sales of $1,700 million and employ about 27,000 people in 40 plants in the United States and abroad.

I am responsible for the the company's operations in the product areas of super-minicomputers, distributed data processing systems, word processing systems, interactive computer terminals, digital Public Branch Exchanges, the so-called PBX telephone systems; computerized control systems for electric power utilities, pipelines and railroads, and text processing systems for newspapers and in-plant printing operations.

My statement will emphasize the developing trends in computing and communication services over the next decade. The two disciplines of computing and telecommunications are becoming increasingly intermingled as you in the Senate and other users such as you demand more and more information which can only be achieved by increasing compatibility between individual systems. Hopefully, my talk will serve as an overview for your committee in assessing your future office systems, data processing and professional information processing and communication needs.

As background for this discussion, I might define the 1960's as what we call the era of the central computer. In those days, we literally carried the work to the computer in the form of punched cards or paper tape or magnetic tape. This was followed by the 1970's by the era of remote terminals, and distributed data processing and the era in which we were able to develop the technology to access computer power from remote locations.

The Senate has subscribed to this type of distributed processing, as has been discussed here this morning, and as is evident by the large base of computer terminals installed here in the Russell and in other types of computer networks which you have established to communicate with your data bases in your home cities and with other data bases such as the Library of Congress.

The 1980's will probably be known as the era of functional integration, the era in which computing, data processing, word processing, and communications were brought together into a truly integrated information processing system. During this timeframe, you will be able to input, review, retrieve and modify all types of information—text, data, voice, video—possibly from a single multifunction desktop device. This increased capability is achievable because of the higher level of integration and power which has been made possible by a microprocessor or chip technology and because of en-

hanced communication interfacing techniques which we call local area networking.

Focusing for a moment on the U.S. Senate and why these networks play such a vital role in your everyday operations, let's briefly look at the type of processing and systems which you are currently using. We think as with all business your most valuable asset is people, and their most valuable resource is information. Information in the form of words, data, voice, graphics and video.

To date, in the Senate, you have tried to meet these individual processing requirements by introducing singlefunction terminals. For instance, to handle text processing, you have installed intelligent typewriters and some standalone and clustered word processing and terminals attached to computers. To provide data from your host mainframes, you have installed interactive or distributed data processing terminals. There are numerous facsimile machines in your operation and of course fundamental to your operation is a voice switching PBX telephone system. And you have also installed automated composition and printing equipment in the U.S. Government Printing Office, some of which I am proud to say was supplied by Harris. And further we are currently installing binding systems for the Congressional Record and the Federal Register at this time.

While all of these systems were designed to do their individual job well, they simply were not designed to do them well together; and we think this causes major problems. These problems, simply stated, center on the lack of efficient information exchange between the different types of systems. We can never truly increase professional productivity until we reach an era in which any operator at any terminal can easily access the information that he or she needs to do his or her job. Without this kind of integration, we will be plagued with duplication of effort, competing data bases and fragmented interoffice communications.

The goal of integration is to provide as much connectivity as possible between as diverse a range of devices as is possible, and to integrate these multiple independent systems can only take place with the successful introduction of what we call in the industry a local area network. I will use the word "LAN" to stand for Local Area Network in my discussion.

A LAN makes it feasible for an individual worker in your office to access computer power, perform word processing, transfer documents, share files, share resources, such as printers and storage devices, as well as provide telephone and voice messaging capabilities. In a given organization, you may have different departments with different systems capabilities and different systems needs. With a Local Area Network each of these people in these various departments can have access to the total system capability of that department through their own multifunction terminal without necessitating the full complement of expensive peripherals and output devices.

In addition, the local area network allows access to the total organization through interconnection to other local area networks and to other locations through gateways to wide area networks.

Now, let's focus just for a moment on the competing technologies and topologies used to implement local area networks. They range

from simple loop circuitry, rings and star configurations to the use of very sophisticated multiple access baseband and broadband modulated busses, or electronic busses. An intermediate level Local Area Network alternative is the use of a modern digital PBX, or integrated voice/data switch, which will switch data traffic among connected devices, and we think it is likely that an optimum local area network may well be an integrated hybrid configuration utilizing the PBX. I further suspect that the local area networks of many organizations can be satisfied by a future generation of PBX.

The primary development thrust in our industry today, in addition to the PBX data switching capability is on bus topology local area networks, with both baseband and broadband modulation or signaling. Both systems use coaxial cable, which requires much less space than conventional wiring to handle the same information traffic. One of the key controversies in our field today is the struggle between baseband and broadband system proponents.

Briefly, baseband networks employ direct information signaling on the coaxial cable at rates up to 10 million bits per second. Access of multiple devices of the cable is controlled by a carrier sense multiple access methodology or in some cases by token passing, passing the control of the system to an individual terminal.

The advances of baseband systems include simplicity and lower cost, distributed control of the passive network, straightforward reconfigurations and network interfaces which will be relatively inexpensive and readily available. There are, however, some disadvantages. The network has limited scope of applications, as it is not well suited for voice or video transmissions, and noise immunity; that is, immunity from external sources over long distances is a problem.

Broadband systems differ from baseband in a number of ways.

First, broadband systems use common cable television cable, and information signaling is impressed on a radio frequency carrier, not unlike the channels on your television set. These require a modem at each connection point.

The advantages include a wider bandwidth, which enable the networks to handle in addition to text and data, a number of ancillary services, such as voice, facsimile and video. The higher cost of broadband modems, additional hardware requirements and a dependency on one network for all of your services, voice, data and others, are among the disadvantages of the broadband network..

Let's attempt to draw some conclusions from this quick review of local networks and our knowledge of evolving office systems requirements.

Industry experts do agree that local networks will take as many forms as the users require. You spoke about the different needs of the different offices already this morning. Probably no single product or no single concept can hope to dominate the market because of the diversity of user needs and we doubt if a true industry standard will emerge for some time. Thus, many manufacturers are producing local air networks which are capable of handling high-speed devices which are equipped with sophisticated operating systems, have inexpensive mass storage capability and provide the kind of high-performance communication facilities which allow data and expensive peripherals to be shared among many terminal devices.

That the communications needs of most organizations are expanding rapidly is no secret, nor is the likelihood that a network which solves today's problems will, in a year or so, be incompatible with those needs. That's not sacred either.

Network planners are focusing on intercollecting homogeneous devices, but also they need the flexibility to add equipment for a variety of vendors. Because users are likely to have a mixture of equipment already manufactured by various companies which have been—dealt usually with a variety of incompatible interfaces. Planners must now modify existing computer software, or they must purchase a variety of protocol conversion devices to create an effective network.

In many cases, equipment such as central terminals do not have the capability to perform this network control function.

To solve this problem, I believe that it is critical that a structured communications network architecture be adopted by manufacturers and users alike, both for single local area networks and the more complex internetwork configurations. Products for the integrated information processing system must be designed around and within this architectural concept.

By structured architecture, I am referring to the layering of the software and hardware required to support end-to-end communications between two nodes and between two users in such a system. The International Standards Organization [ISO], open systems interconnect model is such a concept and it provides a framework for manufacturers to design within, in the interest of compatibility. This model, as you may know, has formed the basis for the IEEE 802 local area network standard where it has been extended to local area networking.

Let me briefly tell you what we are doing at Harris in this regard.

Our strategy is to supply a broad range of products like word processors and terminals to simulate, distributed data processing systems, and computers and PBX's, that function as independent systems designed to do their individual tasks extremely well. However, they are all designed to work in tandem with one another by working within the International Standards Organization's interconnect model.

Our approach to local area networking is modular and recognizes that each organization has a different set of user needs. Consequently, we will provide a baseband local area network to connect our information terminals products. Future configurations will include our next generation PBX to switch both voice and data as well as the controller of a PBX centered local area network and as an integral part of a hybrid network. And finally, we will deliver a broadband system which will accommodate the full range of voice, data, word, and graphic communications. The key to this strategy is that our system is easily upgraded from one level of sophistication to another and will be compatible with what we think is the most probable industry standards.

A system designed in this manner will allow Harris work stations to have access to any other station in a local complex and, through a wide-area network, to a similar or related work station in other parts of the total system. And we have systems such as

this working within areas today. And this network will support a device which is manufactured by others. Since this local area network is structured around the International Standards Organization's architectural model, it may be modified with little impact as necessary to comply with de facto or real standards as they occur in this industry. In the meantime, we feel that the layered architectural approach is the nearest thing we have in the industry to a standard.

We thank you very much for allowing us to present these brief views on this important issue, and I will be pleased to attempt to answer any questions you might have.

The CHAIRMAN. Thank you very much, Mr. Davis.

Senator Hatfield, do you have any questions?

Senator HATFIELD. Well, Mr. Chairman, I would just like to thank Mr. Davis for a very eloquent statement. This will be one I will have to reread again because I want to make sure I got all your points.

Thank you very much.

The CHAIRMAN. Well, I agree that Mr. Davis has given us a lot to think about.

You touched on the question of personal computers and executive work stations. We are a little sensitive about that phrase "personal computers" around here.

What do we call them, Mr. Swearingen?

Mr. SWEARINGEN. Desk top computers.

The CHAIRMAN. Desk top computers. We wouldn't want anybody to get the wrong idea of a personal computer. [Laughter.]

But we have been frankly reluctant to authorize too rapid an advance in this area because of our concern about the proliferation of this equipment and different kinds of equipment designed for this purpose in the Senate.

What do you think the benefits and the risks are of this kind of proliferation? Are we being too conservative, or should we go faster?

Mr. DAVIS. I personally share your conservative approach in that matter, because I think that the proliferation of individual elements without a well-thought-out integration strategy or network may be counterproductive. On the other hand, there are points in favor of personal computing or desk top computing.

The CHAIRMAN. There will be some people who will be very pleased to hear that Senator Hatfield and I are two conservatives. [Laughter.]

They may even be surprised. [Laughter.]

Mr. DAVIS. The so-called desk top computer is due to begin to make all of us in the office, whatever our particular function, more conversant with and more comfortable with applying this new technology which we are going to have to apply to be competitive in the world situation in which we are living, in order to process information. So I think it is a two-edged sword, and in our particular company, we are attempting to make sure that we bring in so-called personal, professional or desk top computers which are designed to be compatible within what we think will be the most likely network standard that exists.

The CHAIRMAN. In the various comments that Senator Hatfield and I have been describing, ones we have received from other Members of the Senate, we have heard a lot about integrated voice and data PBX's. Since this is an educational session, can you explain exactly what the differences are between what we have now in the Senate, which is voice-switching PBX's and telephones, and the new generation of PBX's that people are saying we want right now.

Mr. DAVIS. I could attempt to.

The basic difference is that the PBX's which you have today are, while they may be a digital switch, the information that is received at the control or active switch is analog in fashion; that is, a continuous—not broken up into discreet digital elements. And that poses some difficulties. The new generation PBX's which are being introduced now, many of which are being designed now, some of which have been introduced, will switch—are true digital devices which have a capability in many cases to digitize voice at the hand set or at other locations and as such the PBX is designed to accept digital information. What this means is that you are able under these kinds of systems to switch large amounts of data, computer data, from terminal to terminal through the same PBX system that you use to switch your voice today, so that you can have more efficient utilization of that controller and of the wiring for your telephone system so it can be used both for voice and for data.

The CHAIRMAN. Give me an example of an actual office product——

Mr. DAVIS. Well, you might have an opportunity to talk, you might have an occasion to talk to someone in one of your—within one of your staff offices, and you may have, as an example, in the future, on your desk a terminal which is an integrated telephone and data terminal and as you are talking to that person on that telephone system you may ask for some information which in the past someone would have brought in your office and laid on your desk or we'll just try to describe——

The CHAIRMAN. An hour later or a day later or a week later?

Mr. DAVIS. Right.

And under this kind of system you could actually switch that data right on the telephone to the terminal which you are talking from, and you could view that data and modify it and interact with it with the other person simultaneously.

The CHAIRMAN. They would call it up on a keyboard where they are——

Mr. DAVIS. And send it to you on your and display it on your—you know.

The CHAIRMAN. Does the Senate need this kind of sophisticated equipment yet?

Mr. DAVIS. Well, I think you and this committee are much—and the staff members who are working on it——

The CHAIRMAN. What would be your advice?

Mr. DAVIS. I think that this type of access to information is—and I think Mr. Olsen eloquently stated it when he said that, you know, there is—you are trying to measure the effectiveness of your time and your peers' time in the Senate, and that's—it's impossible to measure that. You must have access to the—the amount of infor-

mation that you have to assimilate each day is growing, as you know better than I, every day, every month, every year; and in order to be able to cope with these kinds of informational needs, you are going to have to have this kind of technology. I believe the best approach to move into this technology is in a modular building block fashion so that you build on the capabilities you already have.

The CHAIRMAN. I raised with Mr. Olsen the question of some kind of standards, and particularly when we have different vendors for different parts of the system.

Do you have any thoughts on that?

Mr. DAVIS. I basically would underscore here statements on standards. We——

The CHAIRMAN. Compatibility——

Mr. DAVIS. Compatibility is fundamental, and we believe that we must, manufacturers and users, must demand—as a matter of fact, the manufacturers must supply products which can be easily interconnected together. Unfortunately, this is a very, very difficult problem to address, and we do have a voluntary standards organization who are working and have been working for some time on this, and I would say some progress has been made in developing a broad framework in which to work. To go the next step is more painful because each of us believe that the techniques that we have adopted are the best, and we would accept any standard as long as it is our own. And so I think that there is a—we must have standards which will insure compatibility but not hamper innovation and hamper advancing technology in its very important information, technology and information processing field. And so I think it is a very serious subject that requires lots of deliberation.

The CHAIRMAN. What about local area network standards? Is that a likelihood?

Mr. DAVIS. Well, I think single local area network standards precise, defined standard is not a likelihood in the near term. Because there are both technical differences of opinion as to how this might be accomplished and there are economic differences based on where each particular participant in the industry or user are coming from. So I think it is not likely—I think it is more likely that there will not be a single standard, nor do I believe that would necessarily serve the best purpose. Multiple standards may very well be the best solution. A single standard for an individual organizations such as the Senate, but maybe not a single standard for all industry.

The CHAIRMAN. For all of the Washington area, or——

Mr. DAVIS. Maybe. Or some compatibility between those.

The CHAIRMAN. Well, that's very, very helpful to us, Mr. Davis, and we appreciate very much your being here.

Mr. DAVIS. Thank you, sir.

The CHAIRMAN. Thank you very much.

[The prepared statement of Mr. Davis follows:]

PREPARED STATEMENT OF JACK C. DAVIS ON BEHALF OF HARRIS CORP.

Mr. Chairman, my name is Jack C. Davis. I am Senior Vice-President, and Sector Executive of Harris Corporation's Information Systems Sector. Harris Corporation manufactures, sells, installs and supports high technology information processing

and communications systems equipment. I am responsible for the company's operations in the product areas of super-minicomputers, distributed data processing systems, word processing systems, interactive terminals, digital Public Branch Exchanges (PBX) telephone systems, computerized supervisory control systems for electric power utilities, pipelines and railroads and text processing systems for newspapers and in-plant printing operations.

We sell these products to a wide range of industrial, financial, insurance, manufacturing, and educational organizations. I'd like to add that we also have a large and growing installed base in local, state and federal government agencies. Harris' annual sales are over $1.7 billion dollars and we employ some 27,000 people in 40 plants in the United States and around the world.

This statement will emphasize the developing trends in computing and communications, services over the next decade. The two disciplines of computing and telecommunications are becoming increasingly intermingled as you demand more and more information which can only be achieved by increasing compatibility between individual systems. My talk will serve as an overview for your committee in assessing your future office systems, data processing, and professional information processing and communications needs.

As background for this discussion, we might say that the 1960's was the era of the central computer. In those days, we literally carried the work to the computer in the form of punched cards or tape. This was followed in the 70's by the era of remote terminals and distributed data processing—an era in which we were able to develop the technology to access computer power from remote locations.

The Senate has subscribed to this type of distributed processing as is evident by the large base of terminals installed here in the Russell Building, and the other type of computer networks you've established to communicate with data bases in your home city offices and other data bases like the Library of Congress.

The 1980's will probably be known as the era of functional integration—the era in which computing, data processing, word processing and communications were brought together into truly integrated information processing systems.

During this timeframe you will be able to input, review, retrieve and modify all types of information—text, data and voice—from a single multifunction desktop device. This increased capability is achieveable because of the higher level of integration and power made possible by computer on a chip technology and because of enhanced communication interfacing techniques which we call local area networking.

Focusing on the United States Senate and why these networks play such a vital role in your everday operations—let's briefly look at the types of processing and systems which you are curently using.

Your most valuable asset is people, and their most valuable resource is information. Information in the form of words, data, voice, graphics and video. To date, you have tried to meet the individual processing requirements of your people by introducing single-function terminals and devices. For instance, to handle text processing, you've installed numerous intelligent typewriters, standalone and clustered word processors. To provide data from your host mainframes, you've installed interactive or distributed data processing terminals. There are numerous facsimile machines in your operation and of course a voice switching PBX telephone system. And you have also installed automated composition and printing equipment in your printing departments, some of which were supplied by Harris. Further, Harris is currently installing binding systems for the Congressional Record and Federal Register.

While all of these systems were designed to do their individual jobs well, they simply were not designed to do them well together. And this causes problems.

These problems, simply stated, center upon the lack of efficient information exchange between different types of system. We can never truly increase professional productivity until we reach an era where any operator at any terminal can easily access the information he needs to do his job. Without this kind of integration, we will be plagued with duplication of effort, competing data bases and fragmented inter-office communications.

The goal of integration is to provide as much connectivity between as diverse a range of devices as possible, and the integration of multiple independent systems can only take place with the successful introduction of a Local Area Network (LAN).

A Local Area Network makes it feasible for an individual worker to access computer power, perform word processing, transfer documents, share files, and share resources such as printers, storage, and other peripherals, and to provide telephone and voice messaging capabilities. In a given organization, you may have different

departments with different systems capabilities and different systems need. With a Local Area Network, each of the people in these various departments can have access to the total systems capablity of that department through their own multifunction terminal without necessitating the full complement of expensive peripherals and output devices. In addition, the Local Area Network allows access to the total organization through interconnection of the local area network and to other locations through gateways to wide networks.

A local network offers efficiency and ease of use, resource sharing among different equipment types, and accommodates simple moves, changes and functional additions within a facility. In addition, the network concentrates local traffic for gateway interfacing to wide area communications facilities.

Now, let's focus for a few minutes on the competing technologies and topologies being used to implement local area networks. They range from simple loops, rings and star configurations to the use of very sophisticated multiple access baseband and broadband modulated busses. An intermediate level LAN alternative is the use of a modern, digital PBX (a Voice Data Switch) to switch data traffic among connected devices, and it is likely that an "optimum" LAN may well be integrated hybird configuration utilizing a PBX. I suspect that the LAN needs of many organizations will be satisfied by a future generation PBX.

The primary development thrust today, in addition to the PBX data switching capability, is on bus topology LAN's with both baseband and broadband modulation or signaling. Both systems use coaxial cable, which requires much less space than conventional wiring for the same information capacity.

One of the key controversies in the local network field is the struggle between baseband and broadband system proponents.

Briefly, baseboard networks employ direct information signaling on the coaxial cable, at rates up to 10 million bits per second. Access of multiple devices to the cable is controlled by a carrier sense multiple access methodology, or in some cases by token passing. The advantages of baseband systems include simplicity and lower costs, distributed control of the passive network, straightforward reconfigurations and network interfaces which will be relatively inexpensive and readily available. There are some disadvantages, however. The network has a limited scope of applications, as it is not well suited for voice or video transmission, and noise immunity over longer distances in a problem.

Broadband systems differ from baseband in a number of ways. First, broadband uses common cable television cable, and information signaling is impressed on a radio frequency carrier, which requires a modem at each connection point.

The advantages include a wider bandwidth, which enable the network to handle in addition to text and data, a number of ancilliary services, such as voice, facsimile and video. The higher cost of broadband modems, additional hardware requirements, and dependency on one network for voice, data and other services are among broadband's disadvantages.

The type of medium required for a system is a strong indicator of both current and future costs. Although baseband cable systems reduce modem costs, they cannot handle simultaneous multiple transmissions. This means that wiring may have to be duplicated to handle each additional function. This is a very expensive proposition, and probably the leading cause of the push toward broadband coax. Today, many vendors are relying on broadband and looking to fiber optics as a transmission medium for the future.

Let's attempt to draw some conclusions from this quick review of local networks, and our knowledge of evolving systems requirements.

Industry experts do agree that local networks will take as many forms as users require. Probably no single product can hope to dominate the market because of the diversity of user needs and we doubt if a true industry standard will emerge for some time. Thus, many manufacturers will produce local networks capable of handling high speed devices, and equipped with sophisticated operating systems, inexpensive mass storage, and the kind of high-performance communications facilities that allow data and expensive peripherals to be shared among many devices.

That the communications needs of most organizations are expanding rapidly is no secret. Nor is the likelihood that a network which solves today's problems will—in a year or so—be incompatible with those needs.

Network planners' focus has been on interconnecting homogeneous devices, but they also need the flexibility to add equipment from a variety of vendors. Because users are likely to have a mixture of equipment manufactured by various companies, usually with a variety of incompatible interfaces, planners must now modify existing software or purchase a variety of protocol conversion devices to create a

network. In many cases, equipment such as simple terminals do not have the capability to perform network-control functions.

To solve this problem, I believe it is critical that a structured communication network architecture be adopted by manufacturers and users, both for single LAN's and more complex inter-network configurations. Products for the Integrated Information Processing System must be designed around this architectural concept.

By structured architecture, I'm referring to a layering of the hardware and software required to support end-to-end communications by two nodes or users. The International Standard Organizations' (ISO) Open Systems Interconnect model is such a concept and it provides a framework for manufacturers to design within—in the interests of compatibility. This model formed the basis for the IEEE 802 LAN standard where it has been extended as appropriate for local area networking.

Let me briefly tell you what we are doing at Harris in this regard. Our strategy is to supply a broad range of products like word processors, interactive terminals, distributed data processing systems, computers, and PBX's that function as independent systems designed to do their individual processing tasks well. However, they are all designed to work in tandem with one another by working within the ISO interconnect model.

Our approach to local area networking is modular and recognizes that each organization has a different set of user needs. Consequently, we will provide a baseband local area network to connect our information terminal products. Future configurations will include our next generation PBX to switch both voice and data which will be the controller of a PBX centered LAN or an integral part of a hybrid network. Finally, we will deliver a broadband system which will accommodate the full range of voice, data, word and graphic communications. The key to this strategy is that our system is easily upgraded from one level of sophistication to another and will be compatible with the most probable industry standards.

A system designed in this manner will allow Harris work stations to have access to any other station in a local complex and, through a wide area network, to a similar or related work station in any other part of the total system. And this network will support selected devices manufactured by others.

Since this local area network is structured around the ISO architectural model, it may be modified (with little impact) as necessary to comply with de facto or real standards as they develop. In the meantime, the layered architecture is the nearest thing we have to a standard.

Thank you very much for allowing us to present our views on these important issues and I will now answer questions that you might have relative to this subject.

The CHAIRMAN. Our next witness is Mr. Vico Henriques, the president of Computer & Business Equipment Manufacturers Association.

TESTIMONY OF MR. VICO HENRIQUES, PRESIDENT, COMPUTER & BUSINESS EQUIPMENT MANUFACTURERS ASSOCIATION

Mr. HENRIQUES. Mr. Chairman, it is a pleasure and a privilege to be here this morning. I will try to abbreviate what is in my written statement, because it would be repetitive, I think, of what Mr. Olsen and Mr. Davis have said.

I think the thing that characterizes our industry as much as anything else is its volatility. The improvements in product over the past 30 years have been represented by products which have relatively short life cycles, with new products being introduced every 18 months to years or so. This doesn't necessarily mean that the old products are obsolete or cannot be used or have no productive life left, but the speed at which technology has changed has made it possible to introduce newer, faster, less expensive and larger pieces of hardware.

Along with this hardware there is a concommitant problem of software. The progress of software which has been less dramatic than it has been in the hardware area. Where in the hardware area we have been increasing the cost effectiveness of the machin-

ery itself at the rate of about 25 percent a year compounded, in the software it is 4 percent and maybe a little higher. There have been some significant breakthroughs in the last few years which allowed the programing and the software for the computer to be presented to the end user in a friendly way which, we call in the industry "user friendly" systems.

This means that we have developed products which are outside the industrial and more in the consumer use, if that's a good term. That means that people use computers today incident to their business in much the same way that they would use dictation equipment, the telephone, or a slide rule. It is simply another tool with which to do their work. The reason is that they don't have to be specialists and they don't have to take specialized courses either in programing or systems analysis or computer science.

The thing that this brings to mind is that there is a wealth of, a virtual cornucopia of, products and applications that are available to the user. The user can utilize a great deal more power easily available to him, than he did even 5 years ago.

Another development is the aforementioned blending of information processing and telecommunications functions. I am sure you realize perhaps better than any of us that the significant events of the last year in the regulatory actions of the Federal Communications Commission in the proposed legislation both in the House and the Senate under the reform of the Communications Act, and the recent judicial action on the consent decree with the American Telephone & Telegraph Co., illustrate this convergence that data processing and telecommunications have come together and are in fact the same business.

What this means is that benefits which were difficult to obtain in separated businesses now will be generally available through simplified business organizations and at reasonable costs to a wide range of users.

So these three things, technological advances, progress in software and the blending of data processing and telecommunications have advanced a wide range of products that are now being offered, but they bring some problems. I would like to touch on these because I think it ties back into what Senator Hatfield said earlier.

First is complexity, and that is, understanding what is available and choosing the right combination for the particular set of needs that a user may have. Clearly the Senate has at least 100 different end-user needs because there are 100 offices and then after that the committees and the specialized activities, and it is a very complex user situation.

Security, reliability and privacy; that is, the needs of the particular user to create and use files and information in which he has confidence that the information is secure; that the system will perform reliably when needed, and that the privacy of those about whom information is collected will be preserved.

Standardization—and you have mentioned that on several occasions this morning—but what standards are needed to allow the users to communicate with one another without stifling innovation in a sort of a macro sense, but also in a much ignored area in the micro sense where agreements on standard ways of utilizing information systems are made so that everyone in an office can greatly

benefit from the system. Those would not be, what I would call in the broad sense, industrial standards, but local conventions: what is it that is agreed on as the way to index a file, as an example, what has the most utility to the most numbers of Members in the Senate for accessing particular kinds of information.

Another problem is ease of use; that is, the ability to use new information systems without requiring lengthy specialized training in order to gain the benefits. We note in the industry—in the desk top computer, there tends to be a gadget syndrome, that when they are very new, people tend to play with them quite a bit, and when they got on top of the system, then the usage goes way down. This is not necessarily bad from the point of view that if the machine or the system is a tool, the same as a telephone, you don't need to use it 8 hours a day to get its full potential benefit to you. In fact, I think we would all be a little bit upset if we found people in our offices on the phone hours a day rather than attending to the other kinds of business that we should do.

And finally—and this was alluded to earlier in one of your questions—is the support and service. Now, that is, the ability to make the system work reliably and up to expectations.

It is clear that as the cost of products diminish, the relative cost of support, maintenance and service, increases. More and more the end user will have to assume responsibility for servicing and supporting his own system and not rely on vendor personnel as the product support service. The technology can help us do this. It is possible now to do remote diagnostics of equipment while it sits in your office, in fact, finding what the error is, simply mailing or sending you a part which you or one of your staffers can place in the machine or replace the machine to cure the ailment which may be afflicting the system.

And so, I think that what is available needs to be understood, what the Senate should have needs to be agreed on and the kinds of applications that may extend what is in the current Senate system are the things that should be looked at.

For example, internal message handling for the members of the staff may be slightly different from the electronic message system which exists among the offices of the Senate Members. Scheduling, which was alluded to earlier, is also a readily available tool that may differ from Member to Member. A long term schedule, that is, looking 4 years into the future or 5 years into the future, and planning where the windows are of opportunity for hearings, for personal appearances, for District visits and that kind of thing might be of significant value to a member, but differing from Member to Member. Specialized data bases; that is, the kinds of things which are of particular importance to the Member and his committee assignments would be useful. The budgeting and accounting for the Member's office, which is always a small business problem, that is making sure that the funds are used for good and sufficient purposes, is a significant concern for the Members.

And then lastly, home computers, the idea that Senator Hatfield mentioned earlier, of being able from your own home, whether that home is in Washington or its environs or whether it is back in the home District, being able to get into the system to manipulate and work with the files that exist.

To realize these things, I think one thing stands out: That everyone who works in the Senate, Members and staffers, are not going to become specialists in the use of this equipment, nor in the software that is available. I would suggest a support facility, centralized support facility, capability or whatever you want to call it, which would be able to assist and to guide the individual Members' offices in their acquisition and continued support of such systems. This means that if there is a problem, that can be stated in lay terms, someone, a professional in the information sciences or information systems area, can translate that requirement into what is available and make suggestions or alternative considerations for the Members, so that he can pick the proper set of equipment, the proper set of interconnections and the proper set of software to make his particular needs be fulfilled.

Mr. Chairman, these are my remarks. If there are any questions you have, I would be happy to try to answer them.

The CHAIRMAN. You referred to the standards question, and I don't know of anybody better able to come before this committee and tell us how well the industry itself is doing in coming to some agreement as to standards available to protect the customer.

Mr. HENRIQUES. Well, I think the easiest thing to say is, that the voluntary standards system allows the customer to protect himself. More specifically there is a project which is being conducted internationally–and the reason for its internationalism is so that we don't have to redo the standard, having developed it domestically and then finding out it won't work in Europe or in Asia.

The standard describes the ability to interact with information systems from the very elementary level through seven levels to the highest possible complexity of structuring information files and doing specific kinds of applications. Fortunately, the low level or the elementary levels are easy to do. They are very simple protocols that are agreed upon that have tended to grow largely out of the telecommunications side of the industry. And these are for all installations in place today. The X-25 standard of the international telegraphic union is essentially that with which any machine can talk to any other machine. It does not necessarily mean, however, that the machines are designed to that standard and they may have to have special software tricks or hardware tricks in order to be compatible at that level.

As we move upward in levels of complexity, that is where the agreements are really difficult to achieve and perhaps even the nature of the problem is difficult to understand. I have sat in meetings with some of the standards specialists in this particular area of open systems interconnection and have found that simply agreeing on terms, concepts and modes of operation are almost beyond possibility. They are working at it very hard. I think critical to the effort is that the user is participating in this and helping to drive this solution by saying, these are the requirements that we have.

As the standard is being developed, the ancillary questions of security and reliability come in, and each of those has to be addressed as an exposure is uncovered. And I think it is going to be some time before the standards, if there is a family of standards coming from this will be in place. But I think it is fair to say that there are elementary standards which can be provided now, both

hardware and software, to achieve interconnection, and that as we go on, the industry will make its best effort cooperating with the users to develop the higher level standards to make it even easier, faster, and more secure.

The CHAIRMAN. There is one thing that even a layman, even an English major, can recognize about the computer industry: That the technology seems to move very fast. And it seems to me as a layman to go in bursts on occasion. If we decide on a course of action in the procurement of equipment and software, and I must admit part of the problem is right here, that our decisionmaking process is sometimes very slow—but having made decisions, what assurances do we have that what we have contracted for won't be obsolete by the time we get it installed?

Mr. HENRIQUES. Well, I think that's two parts of the question. One of them is that whatever you pick and install will surely become obsolescent as time moves on reasonably quickly because that's the nature of the technology. This does not mean, however, that you should not acquire current technology. As I said earlier, there are systems that are 7 to 10 years old that are still very productive, still handle the job that they were intended to do both in industry and in Government today. I think that the most critical thing that you can do, having made the decision to get new equipment or new systems, is to be as modern as you are comfortable with at the time of acquisition. In that sense, I would like to suggest that you not have the leading edge of technology installed here as a sort of test, rather you should acquire products that are now a broadly available commercial products.

I think the other part of the question deals with looking at the plan for a decade, so that during that period of time you can enhance or upgrade what you have easily, so that it is not a revolution, so that it is not a complete turnover in order to make the system a little better, a little faster, and to take advantage of the technologies that are being introduced in that 10-year period.

The CHAIRMAN. So you are suggesting sort of an incremental approach?

Mr. HENRIQUES. Yes. I think Mr. Davis said it was modular, you could say incremental; but I think the key element of that is planning at the beginning to take advantage of what may be available 5 years down the road.

The CHAIRMAN. I remember a number of years ago talking to Ed Uhl, the chairman of Fairchild, and he was predicting, accurately as it has turned out, that the explosion in communications technology would be as exciting as the space advances had been in the previous 10 years.

How has computer technology merged with communications technology? What is this going to mean to customers here—to Senator Hatfield, who wants to operate, literally, on two sides of the continent, in his Washington office and in his Oregon offices?

Mr. HENRIQUES. Well, I think the first thing is the technical or technological direction that Mr. Davis alluded to; that is, the digitization of communication. That means that whatever it is you want to do, whether its image processing, or voice, text, or numbers, can be all done through this same network. You don't have to have specialized equipment to handle one relative to the other.

The second thing that it promises or makes available are collections of information on scales that today are simply physically and economically impossible. For example, it is possible to have on a video disc volumes and volumes of information readily accessible simply by plugging it into the machine rather than having not to look at information because it was too hard to get to.

The use of the combined digital information and image and voice all in the same network, means that Senator Hatfield can sit in his office in Washington and confer fully with his staff and his colleagues in Oregon, having in front of him text, having face-to-face communication and having verbal exchanges. I think this kind of thing that is just around the corner with the broad band transmissions and the blending of the telecommunications and the information processing technology.

The CHAIRMAN. But it is still around the corner?

Mr. HENRIQUES. Well, it's here and demonstrable, but it has not been made in very many commercial offerings and I think largely because of the uncertainty in the regulatory and the legal framework in which it was to be offered. I think much of that has been sorted out over the last year. There is still a little sorting out left to do, but we feel a lot more comfortable now that we know who is going to be in the business and under what conditions, what kinds of things can be offered.

The CHAIRMAN. Well, we thank you very much for your advice and counsel.

Mr. HENRIQUES. It's a pleasure. Thank you.

[The prepared statement of Mr. Henriques follows:]

PREPARED STATEMENT OF VICO E. HENRIQUES, PRESIDENT, COMPUTER & BUSINESS EQUIPMENT MANUFACTURERS ASSOCIATION

Mr. Chairman, members of the Committee, it is a privilege to be able to share with you some of my ideas and observations on the directions that our industry is going to take during the '80s. The Computer and Business Equipment Manufacturers Association has a membership of 43 companies which manufacture products and supplies, and provide services across a wide range of computers and business equipment.

The state of the industry today is characterized by volatility. Over the last 30 years there has been, and continues to be, rapid and dramatic improvements in the hardware of the industry. The products represented have short life cycles, and a major characteristic of the industry is the introduction of new technology and new products in a continuous stream, with each product being improved or superseded on an eighteen month to three year time scale. This does not mean, however, that those products older than eighteen months or three years have no utility left. Quite to the contrary, older products have useful lives far beyond the changes in technology which occasioned the introduction of new products. This push for the introduction of new products, however, comes from the development of new technology which provides equipment that operates faster, is less expensive to build and operate, and can handle larger and larger jobs. I have attached to my statement a graph which illustrates the dramatic improvements in the hardware produced by our industry, in terms of capabilities, costs, size and operating efficiency.

A second area of significant change is in the progress in software, that is progress in the programs and instructions which enable a person to communicate with the hardware to get the job done for which the equipment was purchased. Within the industry, we have an expression called "user-friendly". This means that the user of the hardware and software need not be expert in computer science in order to make efficient use of the hardware and software to solve his problem. The development of new software and breakthroughs in programming techniques have permitted the industry to offer "user-friendly" systems which have carried the application of information technology beyond the specialists to those who treat information handling systems in the same way as they would other tools of their trade. This progress in

software and the production of small, economic hardware has enlarged the industry from an industrial market into a consumer market. This means that modern technological information handling equipment is easily accessible, economic to acquire, and is not difficult to learn to use in a variety of new applications.

A major development of the industry is the blending of the data processing and telecommunications functions. The significant events of the last year, in terms of regulatory actions such as the FCC's Computer Inquiry II, proposed legislation on the Communications Act of 1934, and judicial action regarding the Consent Decree of the AT&T company, simply illustrate that the convergence of data processing and telecommunications is a fact, and that benefits of both are broadly available through simplified machines at reasonable costs to the widest possible range of users.

As a result of these three things, technological advancement, progress in software, and the blending of data processing and telecommunications, there is an expansion of product horizons, which provides the user with unimagined benefits. However, it also creates some problems as the benefits of the technology are brought closer to the individual.

These problems include:

Complexity, that is, understanding what is available and choosing the right combination for the particular set of needs that a user may have;

Security, reliability and privacy, that is, the needs of a particular user to create and use files of information in which he has confidence that the information is secure, that the system will perform reliably when needed, and that the privacy of those about whom information is collected will be preserved;

Standardization, that is, what standards are needed to allow users to communicate with one another without stifling technological innovation in a macro sense, and then in the micro sense, the agreement on standard ways of utilizing information systems so that everyone in the office can gain benefit from the system;

Ease of use, that is, the ability to use new information systems without requiring lengthy specialized training in order to gain the benefits. Ease of use also indicates the ability to transfer the skills from one system to another;

And lastly, support and service, that is, the ability to make the system work reliably and up to expectation. As the cost of products diminishes, the relative cost of support maintenance and service increases. More and more, the end user must assume the responsibility for servicing and supporting his systems, and not rely on the vendor as the primary source of such support and service. Only in this way will the user truly reap the available economic benefits.

Let me now turn to the evolution of applications. I have attached to my statement a diagram which shows the movement of different kinds of applications through increasingly sophisticated equipment into integrated information systems. For example, the processing of numeric applications such as statistics or accounting evolves from the use of calculators, to mainframe computers, to micro or personal computers, and ultimately into information systems. In the same way, images were processed through copiers, and then through facsimile and photocomposition devices, to digital image processing, and finally integrated into information systems. The same progression can be shown for both voice and text application.

What this suggests is that the user now can specify what he wants done with little concern about the availability of an appropriate technology to accomplish specific tasks. Certainly, the questions of economics and efficiency will enter into the final decision about the combination of equipments and technologies to handle the applications, but there is sufficient flexibility today to assure that a user's needs can be met technologically, and that the user need not hamper his own imagination in the solution of his problems.

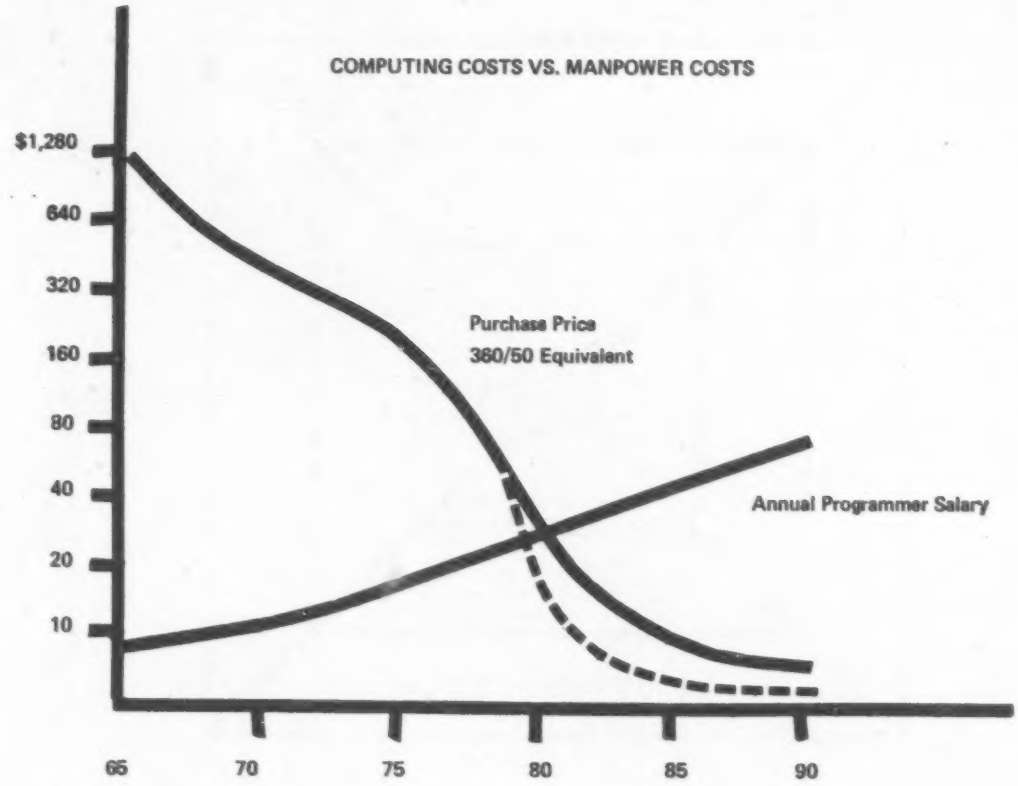
I will now give some specific instances. I know that the offices of the members of the Senate and of their committees have terminals connected to a central processing facility, which can in turn connect them to the Congressional Research Service, and through it, to data bases around the country. I am familiar with the letter production system, and with the electronic messaging that is possible through this system. Beyond these, however, there may be special requirements in a member's office which can be satisfied through intelligent application of the appropriate technology to the solution of the particular problems of that member's office and constituency. These applications may incude internal message handling for the member and his staff, scheduling of the member's time on a long term, that is, multi-year basis, which would include matching the member's schedule with other known schedules to assure the best use of his time when he is in Washington or in his home state, specialized data bases which can be developed, maintained, and readily available to the member and his staff for particular problems being addressed by the member,

budgeting and accounting for the member's office to be tailored to the specific needs, size and activity of the office and its staff, and home computing, since it may be appropriate for purposes of efficiency for the member and selective staffers to have the capability in their residences to interconnect with the office system.

All of these things are possible, but the primary question is how to make the benefits of this technology and these applications available to persons whose primary interests and responsibilities are not in the area of information processing and application.

I suggest that you consider having a centralized support capability which could assist a member and his staff in the acquisition and continued support of such systems. This would assure that, while not hampering individuality in the selection of systems or their implementation and operation, there will be support by technically qualified persons to help those who have only a casual interest of the inner workings of such systems. In that way, the users need not be disillusioned because of their lack of detailed knowledge, nor does the user have to waste time and effort looking for answers to technical problems from many different sources.

Again, Mr. Chairman, I thank you for the opportunity to appear today, and I would be happy to attempt answering any questions you or members of the committee may have.


COMPUTING COSTS VS. MANPOWER COSTS
$1,280
640
320
160
80
40
20
10
Purchase Price
360/50 Equivalent
Annual Programmer Salary
65
70
75
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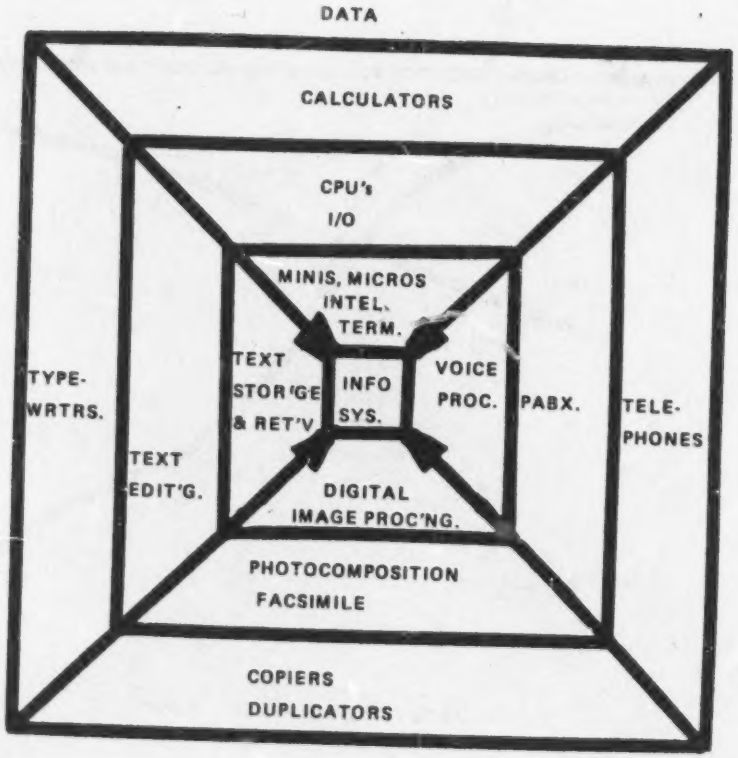
85
90

APPLICATION EVOLUTION



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11/82

Computer and Business Equipment Manufacturers Association 311 First Street, N.W., Suite 500, Washington, D.C. 20001 (202) 737-8888

CBEMA,
December 13, 1982.

Hon. CHARLES McC. MATHIAS, Jr.,
358 Russell Senate Office Building, Washington, D.C.

DEAR SENATOR MATHIAS, As a follow-up to your hearings on December 8th, I am forwarding some materials which expand our industry's position on several of the areas in which you expressed interest. They are:

Information Processing Standards
Copyright Protection and Security [1]
International Trade Policy [1]
Trade and National Security [1]
International Information Flows [1]

Should you or your staff have any questions regarding any of these areas we will be happy to provide someone to discuss them with you.

Sincerely,

Vico E. Henriques, PRESIDENT.

Enclosures.

[1] These materials are retained in the committee files.

Commentary

Information Processing Standards

Vico E. HENRIQUES
President, Computer and Business Equipment Manufacturers Association, 311 First Street N.W., Washington D.C. 20001 USA

Vico E. Henriques, President since 1977 of the Computer and Business Equipment Manufacturers Association, directs the overall activities of the United States computer industry's principal trade association. Before joining CBEMA in 1970, Mr. Henriques was Director of management services with the accounting firm Arthur Young & Company. His previous experience included the direction of technical and management staffs in the National Bureau of Standards, the State of New York and the planning staff, ADP division, of the General Services Administration.

North-Holland Publishing Company
Computers & Standards 1 (1982) 17–19

1. Introduction

The United States needs an even stronger national program than it currently has for the development of information processing standards to support effective international use of this important technology. Such a program would provide a basis to ensure leadership by this country in the development of these standards internationally.

This national program should develop standards with the following characteristics:

- Standards should encourage competition to the maximum extent possible.
- Great care should be exercised to minimize the tendency of standards to inhibit innovation by avoiding premature standardization.
- Standards should be based on functional requirements rather than design specifications.
- Standards should permit flexibility of design.
- Standards should have a minimum negative impact on user applications, programming and facilities. They should reduce duplication and allow well designed applications to have longer lives.

Information processing standards with these characteristics should continue to be developed through the national voluntary consensus standards process which provides for full participation of industry, users, general interest groups and the U.S. Government. The requirements of an effective national program are as follows:

1. Commitment on the part of industry, users, and government to work together through the national voluntary consensus standards process.
2. Development of unified national positions through the voluntary consensus process mechanisms as the basis for national participation in

international standards development activities of the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), International Telegraph and Telephone Consultative Committee (CCITT), and other bodies.

3. Harmonization of national and international standards.
4. Assurance of the most effective use of our national resources necessary to develop information processing standards.
5. Establishment of a set of priorities for standards development.

The following discussion of these requirements highlights the important elements of a strong national and international program.

2. Voluntary Standards Process

The voluntary consensus process is the best vehicle for the development of standards to meet both government and commercial requirements. Such standards can give the government the greatest procurement options and at the same time allow industry to direct its total capabilities to meet the broadest market requirements. It is certainly recognized that in some cases such as national security, the government may have unique requirements justifying specific government standards. Industry traditionally has responded to these exceptional situations.

Through the use of the voluntary consensus process, users as well as industry are provided a mechanism to participate expressing their views and needs and, where they can, cooperate in the technical development of information processing standards. Through this consensus process, standards which have the broadest application and benefit to government, industry and users are established.

3. International Standards

The voluntary consensus process also provides a mechanism to establish national positions and national participation in the development of international information processing standards. National positions established through this process place the U.S. in the optimum position to effectively and constructively influence the development of international standards. This is vital to our national economy. Development of international standards compatible with U.S. standards will increase our industry's ability to export and thus maintain a favorable balance of trade. This process also gives the greatest assurance that development of such international standards will be consistent with the principles of the General Agreement on Tariffs and Trade (GATT) code on technical barriers to trade.

4. Harmonization

Wherever possible, we try to harmonize our national and international standards permitting industry to develop products satisfying worldwide requirements that adhere to the principles of the GATT Code on Standards. Such a procedure would greatly benefit U.S. industry, government, and other users who have international information processing requirements. In this way they can construct their applications to meet both national and international specifications which is particularly important in view of the rapidly increasing growth of information processing worldwide.

The voluntary consensus process provides the best means to achieve harmonization because it affords the broadest participation of all concerned parties, government, industry and users.

5. Resources

Every action necessary to ensure the most effective use of our limited national resources available to develop information processing standards must be taken. The development of standards is a technically oriented process requiring highly skilled individuals from industry, government and users. The time spent by these individuals, the application of their skills and their willingness to participate can be adversely affected by standards efforts which are not justified, not properly de-

fined and organized, in conflict and redundant.

Such situations can occur both in this country and internationally. Therefore, it is important that all participants question standards activities which are not justified, not properly defined and organized, and are either in conflict or a duplication of effort. Through the voluntary standards process, all interested parties would join together to define their needs and through mutual consent, establish a program ensuring the most effective use of available talent.

6. Standards Development Priorities

These programs must take into account the following standards development priorities:

1. Standards required for the meaningful interchange of information
   - Open Systems Interconnection
   - Telecommunications
   - Local Area Networks
   - Text Processing
   - Document Interchange
   - Data Representation
2. Standards that enhance portability
   - Programming Languages
   - Data Representation
3. Standards that enhance data protection
   - Encryption
   - Access Control
4. Standards that enhance the working environment and safety
   - Ergonomics
   - Product Safety

Development of information processing standards is the key segment of our overall national standards program and will require close cooperation between all relevant sectors. The voluntary consensus process clearly provides the best mechanism for the development of these standards and for the enhancement of this needed cooperation. We welcome the government's support and cooperation to build a strong national standard program in information processing.

The CHAIRMAN. Our next witness is Stuart J. Miller, vice president and general manager of Sperry Univac.

TESTIMONY OF STUART J. MILLER, VICE PRESIDENT, OFFICE INFORMATION SYSTEMS, SPERRY UNIVAC

Mr. MILLER. Mr. Chairman, it is a privilege for me to be able to offer my testimony on this very interesting subject. I have prepared written testimony, which we have submitted. I would like your permission to synopsize that testimony.

The CHAIRMAN. Your full statement will appear as if you had read every word of it.

Mr. MILLER. Thank you.

The CHAIRMAN. That's a technology we have achieved around here. [Laughter.]

Mr. MILLER. I would like to address principally three points today, three points which in different ways have been covered by previous witnesses. They address principally the technological leaps that we have been seeing and that we can see in the near future.

And second, I really want to talk about the application of that technology as opposed to the technology itself. I believe that's one of the most important aspects of this issue. And then third to try to be specific about how such approaches could benefit the Senate.

As far as technology is concerned, I like to view the situation as based on four technologies that have assisted the general office function in the last 100 years. There have really been only four principal inventions: the telephone, the typewriter, the copier, and the computer. And of those four, two of them, the typewriter and the computer, have traditionally been perhaps the most difficult to use in terms of the extent of training required.

However, in the last 5 years advances in both hardware and software have eliminated much of this training problem and have brought the human/machine interface much closer to the human than to the machine. Examples are data base access languages, help systems, self training systems in computers, the ability to compute and to handle unstructured data as opposed to structured data, and even terms that we occasionally use now in the computer business such as "application generators."

Now, the most recent pace of change in technology has been so fast that some organizations are literally scrambling to apply the technology as fast as possible. In addition, you have a proliferation of word processors, personal computers and electronic mail systems. They have, in the main, had a piecemeal effect on office information, with just as many negative effects in my opinion as positive effects. For example, the electronic mail systems can proliferate junk mail. When it is easy to send a message to someone, we will send it to 10 people perhaps, instead of 1.

The CHAIRMAN. And that is a point we have to remember here on the Hill. I'm not going to put the blame for this on the computer industry, but coincidentally with the increase in computer equipment on Capitol Hill, mass mailing costs have now broken the hundred million dollar mark. And that's another subject that this committee will be addressing shortly.

Mr. MILLER. In addition, the proliferation of desk top systems or personal computers has often resulted in bootleg data bases and data bases that are not compatible with each other in terms of the accuracy of their information. Often they cannot interface with each other. Also, people do sometimes tend to spend more time programming personal computers than doing their real job, because the computer becomes a toy.

Now, while this has been going on, the development of pure data processing and data base systems has continued independently, and there are therefore many divergent computer systems. The result is that the overall information flow in an organization is usually ignored and the effect of suboptimization is often felt.

The alternative to all this brings me to my second point, the application of this technology. As a previous witness has testified, information systems need integration. The principal we work on is that most office people need different capabilities at different times. And therefore a system can be, has been, and should be installed that addresses these divergent needs from the user's viewpoint. Word processing, desk top or personal computers, data base access, data processing capability, international communications as well as national, external information services should all be provided and can be provided at the desk of the individual with one interfacing device that that human being works with.

The benefit of it is obviously that all staff then can access and use the data with less training time because there is one system to learn. There is more time for improvement in the quality of the office work generated. It becomes easier to link and assemble the different pieces of information that people work with generally. Therefore, the quality of the opinions and decisions is enhanced.

Now, the kind of system I am talking about really functions on three levels. There is the independent personal set of functions, such as word processing, personal computing, and so on, which can be performed independently on that desk station. Second, you can have smaller networks where staffs communicate and share information; they share files and they can handle messages for each other and so on. And then third are the large systems where data base becomes very important and communication services, as we have heard already this morning, become dominant. These communication services do provide access to external resources and they can provide gateways to many different kinds of networks.

In addition, the ability to integrate the spoken word and voice with data is critical—and I will give you an example of that.

While the technology is on the borderline at present in terms of commercial availability, it will be possible in the very near future to annotate a document with spoken comments and have that subsequently retrievable by yourself or by staffs in remote locations.

As far as applying an integrated system to the Senate today, Senator Hatfield earlier on pointed out the reality of the situation. The Senate is a complex organization; it is 100 executive offices, each functioning in different ways where the Senator himself often acts as a business executive.

In addition, the information and support organizations provided to the Senate are already extensive. The management system, the Senate information retrieval system, the policy analysis support

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system and so on are all extensive systems supporting the role and function of the individual Senators. In addition, of course, there are the Library of Congress, the Office of Technology Assessment, and so on, shared with the other body, which also provides information to the Senators.

Now, it is not necessary, to replace these systems in order to get on board with current technology. You don't need to throw out something such as a correspondence mailing system. These systems can be accessed from a single desk station today without a considerable amount of rebuilding. And it is our submission that in fact that is the direction in which the Senate and this administration would want to go.

It would be possible then, to combine proposed legislation with policy pros and cons, interest groups, constituent contacts and so on via electronic filing and in association with the current system. It would be possible to review testimony, statements on legislation before subcommittees and direct other staff to follow up, systems already provide followup services today. Meeting-scheduling capability is available today for scheduling meetings with colleagues or scheduling a presentation speech tour in one's own constituency according to personal requirements. This can be done not automatically with one command to the system, but with sufficient direction from the individual.

Word processing is just one of the functions of course that be provided. Correspondence can also be analyzed on issues through optical character recognition and through electronic filing.

The CHAIRMAN. You passed over word processing very rapidly.

Mr. MILLER. Yes, sir.

The CHAIRMAN. How do you define a word processor?

Mr. MILLER. Word processing in my view is the ability, as Senator Hatfield pointed out, of handling textural information, at a screen level or a full-page level. The original creation of text, the editing of it, the transmission of it, the storage of it, the retrieval of it, the cross indexing and cross filing of it are all aspects, and necessary parts of word processing.

Now, of course, word processing can also interface with a mass mailing system. Once the requisite letter is generated, it can be passed through a mass mailing system for distribution.

Budgeting and accounting, as Mr. Henriques has pointed out, can be assisted from this same desk station. And I should point out that this single unit does provide the full capabilities of a personal computer as well as the word processing and accessing of other information systems.

I think I should point out a couple of cautionary notes. First of all, installing such systems as pointed out by Mr. Henriques, does require organizational commitment; it does require long-term organizational planning. Not in terms of making sure that one accounts for future technological introductions so much as analyzing the information needs of an organization and how current and potentially future technology can be applied to them.

Another cautionary note. The technology should not be acquired for its own benefit. It must support the staff. It must not force them into machine-oriented methods that both require extensive training and also change their own comfortable procedures in han-

dling information. It is true that any change in a system is always seen as a loss even if it's an improvement in the system, and that must be overcome in time.

There are new technologies on the horizon and they are approaching very fast. Optical disc technologies will provide a considerable increase in the availability of storage of information at the desk of the individual himself. In addition, we already are seeing a continued growth in the integration of the telephone instrument itself with the display terminal in such a way that the telphone instrument will be used for the spoken word, at the same time as documents, images, texts, and so on, will be reviewed together on a screen.

The advent of larger storage does mean that digitized voice and digitized image will be able to be stored at the individual's desk level; and therefore the amount of data that is available to any one individual will be considerably increased.

We also are seeing the emergence of text-to-voice systems, which would provide the ability to call in from any telephone and have certain information read back, perhaps in a voice worse than mine this morning.

But nevertheless that technology is getting close.

The CHAIRMAN. You mean you just read it in——

Mr. MILLER. No. To have it read back to you by a machine, not by a person. The machine would for example be able to list all the mail items that came in to you electronically that particular day; you could call in and it could read to you without a human intervention.

The CHAIRMAN. Instead of having it flash on the screen?

Mr. MILLER. Well, the presumption is, Senator, you would be perhaps at an airport where there may be not a screen available. This information would also be able to be presented on a screen.

The CHAIRMAN. I see.

Mr. MILLER. Yes, that's an alternative.

The CHAIRMAN. Or as your first waking moments in the morning, if you couldn't. [Laughter.]

If you couldn't wait to find out who had written you that day. [Laughter.]

Mr. MILLER. Excuse me.

Yes, that's correct.

Another technology which is relevant to this is voice store and foward phone systems, which have already been announced by many companies——

The CHAIRMAN. I'm sorry, I didn't understand.

Mr. MILLER. I'm sorry. Voice store and forward phone systems, which is the ability to call an individual's office and if he or she is not present, to have the spoken word stored on a system for subsequent retrieval by that individual.

That technology also provides for the ability to automatically distribute a personal spoken word message—one way only, of course. It cannot be interactive to a multitude of recipients.

The CHAIRMAN. So it is just more than just a telephone answering service?

Mr. MILLER. Absolutely, yes.

The CHAIRMAN. It would go throughout a whole organization?

Mr. MILLER. Absolutely.

For example, a message could be left from one Senator to his colleagues requesting them to respond with opinions on a subject or an issue, or messages could be sent to critical constituents for subsequent dispatch.

The CHAIRMAN. Of course, that requires listeners. [Laughter.]

Mr. MILLER. I think the final point I would like to make is that the majority of the technology I have discussed is available today. It is applicable in a form that makes it easy to use. And you can use multiple systems; it does not require one supplier to provide a complete system. It does however, require that bridges and gateways be provided between different systems.

My recommendation to the Senate is to establish a long-term plan for an integrated office system and to provide for incremental acquisition of technology as it comes onstream.

Thank you, Mr. Chairman.

The CHAIRMAN. I have raised with other witnesses this question of the adoption of standards because of the many different technologies with different suppliers. We have quoted from the consumer pressure here and from the vendor pressure here, and we are learning more and more about this, but what would you recommend as the kind of standards that we should first adopt around the Senate?

Mr. MILLER. Well, it is my belief, Mr. Chairman, that although standards are evolving at present to provide for technical interconnection of equipment, the issue of the higher level elements of these protocols still remains open. Mr. Henriques has referred to this earlier, as did Mr. Davis. There are activities in areas in the International Standards Organization, for example, where the definition of the open systems interface—open systems architecture—for interconnection of equipment is receiving active attention and active support from many members of the different technological sources of our industries.

In addition, there is activity in the International CCITT telephone standards body in terms of moving toward a digital network standards definition. I believe that requires support.

In terms of a personal recommendation for the Senate, I think reviewing and adopting systems that move toward the International Standards Organization architecture will provide the most basic foundation. Now, there should, however, be, in my opinion, review of other activities such as the efforts by the National Bureau of Standards in terms of electronic mail standards. There are also foreign government activities to define teletex standards, which provide for the compatible interchange of screen oriented documents. I think these activities are of significant importance.

The CHAIRMAN. A great many of the systems today are difficult to install or very complex, and this probably reduces the chance for success for an individual company.

Is this an industrywide problem that is a part of the kinds of systems that you referred to today?

Mr. MILLER. It can apply, frankly, Mr. Chairman, if sufficient care is not taken at the outset in terms of planning what the eventual requirements will be of the system. However, the kind of system I propose is perhaps more modular in approach than some.

And since the different components of the system can function either in stand-alone modes or in small network mode or in a large inter-office kind of mode, it is possible to add components incrementally into the system, having established a principal basic network in the first place. There is always fallback because of this modularity of systems, the fact that complexity usually results from the many different components that are tied into a system. In the kind of system I am discussing, each unit can fall back to a certain level of operation without the necessity to interact with its peers. The system also has enough functional capability such that if elements do fail, then the remaining elements can still perform a certain level of functionality so that to the end user, he or she is still going to be provided with some capability.

The CHAIRMAN. Well, let me apply the ultimate test to you. Let's see what kind of medicine the doctor takes.

What do you use in your office? [Laughter.]

Mr. MILLER. Well, I was interested by Mr. Olsen's question a little earlier because I have a very similar personal example. The preparation of my testimony was done in a similar way. But I also have a system at home, so therefore I can record these marvelous ideas at 3 a.m.—which don't occur very often to me.

Nevertheless, I do personally use the system extensively. From a business point of view, one of the real benefits we have found is the ability to get through the maze of the corporate culture in a much quicker fashion, distributing documents for approval and review by different bodies. Frankly, this can result from the business standpoint in being able to come earlier to market with product than otherwise. And there is no question from a personal point of view that I feel the quality of my job has been enhanced because the drudgery of it has been removed.

The CHAIRMAN. So you feel the results are entirely positive?

Mr. MILLER. Absolutely, yes. There is always a difficulty of quantifying the benefits of the system that I have been talking about, particularly when you are talking about the capital depreciation of around say $2,000 per year per user, for systems provided with all the capabilities I have described here, except the main frame computers. Frankly, it is the quality of decisionmaking that I find more than adequately justifies the installation of the system.

It can still be justified on the productivity of paper, but, like Mr. Olsen, I don't like to justify it that way.

The CHAIRMAN. Is Sperry a member of the research consortium that is being developed within the computer industry?

Mr. MILLER. Yes, Senator, we are.

The CHAIRMAN. Would that research be focused, at least in part, on continued developments in the areas of application that we have been discussing this morning?

I would be interested in whether or not these kinds of problems are the continuing focus of——

Mr. MILLER. It is my understanding that a level of the—the charter of that organization has been targeted toward looking at the human factors and the ease-of-use aspects of systems.

The CHAIRMAN. Well, thank you very much for being with us, Mr. Miller.

Mr. MILLER. Thank you, Mr. Chairman.

[The prepared statement of Mr. Miller follows:]

PREPARED STATEMENT OF MR. STUART J. MILLER, VICE PRESIDENT, OFFICE INFORMATION SYSTEMS, SPERRY COMPUTER SYSTEMS

Mr. Chairman, and members of the Committee, I am Stuart Miller, Vice President for Office Information Systems at Sperry. It is a privilege to testify before you today on how high technology is affecting the office in the 1980's. More specifically, I want to discuss the exciting opportunity that office technology presents to a historic and primary institution of the American government, the United States Senate.

I would like to discuss three areas with you today.

First is the tremendous technological leap forward in computers and communications. This leap has brought the computer's power to individuals not trained in data processing.

Second, I'll talk about acquiring that technology in a systematic way, a way that meets specific office needs. And I'll discuss how technological solutions to related office problems need to be joined together in integrated systems.

Third, I'll show how an integrated, systems approach to the office can benefit the specific needs and functions of the Senate both now and in the future.

First, let me describe where computer technology is going today.

Breakthroughs in the computer and communciations industries sometimes appear to be routine. In the 50's and 60's, computers became more and more powerful, capable of processing data faster and faster. In the 60's and 70's we saw advances in communications that made it easier to transport that data to locations where it was needed.

But during the late 70's, computer manufacturers took a far more important step. We were finally able technologically to make computers significantly easier to use—not just easy to use for data processing employees, but easy to use for people who speak English, not COBOL. The man/machine interface became less oriented toward the machine and more oriented toward the man. Thus, for the first time, we were able to begin applying computer technology to office functions.

There was, of course, some equipment already in the office. Over the previous 100 years, four inventions had dramatically enhanced office information management: the telephone, the typewriter, the copier and of course, the computer. Each technology had developed independently and spawned its own sizable industry. Each tended to support different groups of workers: the secretary used the typewriter; the professional used the terminal. The telephone was, of course, a more universal instrument, though with limited functions.

Because of this historic situation, it was natural that companies should apply the easiest-to-use computer techniques to one type of equipment at a time. Thus, the typewriter grew into the word processor and the telephone into the automatic answering service. And telephones further evolved into networks (including satellites) offering transmission of digital information and pictures in addition to the spoken word.

Thus, today, many office and knowledge workers think in terms of incremental electronic improvements to separate pieces of office equipment. They evaluate separate applications and review individual costs. Unfortunately, that kind of thinking is leading to office chaos.

We have offices that use a time-sharing system for one kind of correspondence and a word processing system for another. And neither system can use the other's data. We have office workers who, for their own or company reasons, may set up "bootleg", outdated and often inaccurate data bases on personal computers, while similar but more frequently updated information resides on a mainframe. We have one system for storing voice messages and a completely different one for storing electronic messages.

That leads to problems. We have training problems when new staff members try to learn all the different office systems at once. We have logistical problems when one system is down and we can't do similar work on another. And we have contract problems where we deal with a dozen different vendors, a dozen different payment schedules, and a dozen different service representatives.

What we clearly need is a different way to look at office automation. We need to get away from piecemeal thinking and jerry-rigged webs of machines. We need instead to develop a top-down, systems-oriented approach to the office.

And that, gentlemen, leads directly to my second point, the need to plan, budget for, and acquire technology in an orderly, integrated way. We need to link separate office technologies together in order to realize maximum efficiency, maximum pro-

ductivity. Thus, office technology in the 80's and 90's is going directly to integrated systems.

An integrated system uses *one* machine—one desk station—to cover the functions of all four office machines—the telephone, the typewriter, the copier and the computer. With just one piece of equipment, your staff will have all the advantages of a data terminal linked to a mainframe, a word processor, an electronic mail system, a system that keeps track of voice messages, a calendar system and a personal computer.

All staff members will be able to access and use the same data. They will keep your records in the ways most useful to them and you. They will spend less time and money coping with separate pieces of equipment and more time working on applications that will help your office run smoothly.

There's another benefit to integrated office systems. They will lead to improved quality of information and, therefore, improved quality in decisions and opinions formed from that information. Let me explain.

Good decisions often depend on having the right information at the right time. An office full of word processors, personal computers and answering machines may generate large amounts of text and data. But if methods to link and assemble that data are cumbersome, office staffs will tend not to link and assemble. Consequently, the quality of your decisions can deteriorate because of operational difficulties at staff level.

Integrated systems make information linkage easy. And when you make it easier for people to do their work, they do more of it. Decision quality can rise significantly when staff members have all the information at their fingertips.

With an integrated system, your staff will use just one piece of equipment to get to every type of information. But that piece of equipment will function at three different levels.

It can operate independently, with no connection to other equipment, for functions like word processing and personal computing.

It can join a small network of desk stations connected through a distributed office processor. This small network lets staffs communicate and share information.

Or it can join into a large system to cross departmental or geographic boundaries, access data processing facilities and data bases, and use voice services. These larger networks may be composed only of minicomputers. Or the network may be joined with a mainframe. In any case, this larger network could link to both national and international communcations services and to subscriber data bases.

Thus, three levels of service—independent, small system and large system—will be available through just one desk station.

The integrated office system is not a dream. Its foundation is here today. We're already feeling its initial impacts. Fortune 500 companies are beginning to adopt and use fully integrated office systems to manage their businesses. They're projecting productivity increases in the millions of dollars.

Thus my third point: A fully integrated office information management system is a practical reality for the United States Senate in the 1980's. I say this knowing that the Senate is not only a unique institution in the history of legislative bodies, but that it is also a complex and diverse organization. It is first of all 100 distinct and separate offices. And those offices are headed by Senators serving as executives—executives who must direct organizations, executives who must administer programs and services for a geographically distant constituency.

The Senate is also the institution's officers with sizable staffs and resources. And it is information support organizations such as Senate Technical and Information Services and the Library of Congress, the Office of Technological Assessment and the Congressional Budget Office, which are shared with the other body.

How will this complex organization benefit from an integrated office system? Let me give you just a few examples of the ways your staff members could use an integrated system to support your daily activities.

A staff member could, at the touch of a few buttons, combine summaries of legislation before the Senate with pros and cons, interest groups for and against the constituent contacts on the subject.

Key staff members could also review all testimony, position statements and speeches concerning proposed legislation before your subcommittee. They could then direct other staff in following up.

An integrated office system keeps clear track of your calendar and helps your staff with calendar planning. For instance, the system could easily assemble the dates and places for possible appearances in your state, compare those dates against openings in your calendar, prioritize the appearances against a list of criteria, and help your staff follow up on media response to those appearances.

An integrated system also helps schedule meetings with colleagues by comparing openings on their calendars. Your staff could tentatively schedule a meeting, send an agenda and request a confirmation from each participant without the need for a battery of phonecalls.

Of course, an integrated system gives you highly sophisticated word processing functions, helping speed the production and update of speeches, position statements, testimony and media releases. It also provides an interface with mailing services already in place.

And the integrated system uses its mainframe connection to analyze correspondence received on various issues. You can request sorts by pros and cons and by geographical areas within the state. You can distinguish between personal letters and letters generated by grassroots campaigns.

While preparing for testimony to be given before your subcommittee, your legislative assistant might use the integrated system to call up a brief and proposed questions from the Committee Counsel's office.

And, of course, budgeting and accounting functions become remarkably simplified with an integrated system.

Your state offices could use this same system, speeding and simplifying communications between your offices. Your state representatives could use the system to determine the status of legislation, confirm your published position on a bill and forward comments and observations to you from your constituents, including voice messages.

Finally, an integrated system vastly simplifies the tasks your offices face in working together to track down lost social security checks, investigate denial of veterans' benefits and assess the impact of legislation and administrative rulings on your constituents.

These are just a few examples of the many ways in which an integrated office system could help you speed, manage, and control your many complex tasks. The possibilities are virtually endless.

But I do want to sound two cautionary notes. First, you cannot realize the benefits of an integrated system without careful planning and an organizational commitment. And second, you need a system that will aid your staffs in doing what they want to do when they want to do it, not a system that requires them to take large and disruptive technological and procedural leaps.

First, let me deal with organizational commitment.

There is a natural tendency today, as I mentioned before, to acquire technology for technology's sake. That can lead to unhappiness because the dispersed applications of technology generally do not result in a cohesive information network.

What institutions need instead is a systemic approach, a coordinated resolution to many problems—some active now, others on the way. Consequently, the system will be acquired and implemented incrementally, over time. Its cost will be greater than the cost of any one of the solutions to any one of the fractured problems. But in the long run, applying individual solutions to individual problems is the high-cost approach to the office.

To take advantage of the savings and efficiency inherent in an integrated office system, the Senate must develop an overall, coordinated procurement process that supports your total, long-range plans. It is not easy to get that commitment from a large and complex organization, but it is vital.

My second cautionary note concerns the type of system you select. You need an integrated office system that supports your staff members, not one that directs them. Such a system must have the flexibility for different staff members to use it in very different ways. It must protect information against both unauthorized intrusions from outsiders and from undesirable access by certain levels of staff. Above all, an integrated system must grow with the increasing sophistication of your staff, supporting new functions as the needs of your office change.

That last point is crucial. Information management systems will grow and change with evolving technology. And I believe it's important for a body such as yourselves to understand what will be happening in the future, particularly when contemplating a major investment.

Within the next five years, we will see further enhancement of today's level of service. The telephone will become even more integrated into the system than it is today, giving your staffs the opportunity to annotate reports by voice and enabling your home and Washington staffs to communicate even more rapidly and accurately. There will be text-to-voice systems, so that you can call into your system and have documents read to you.

There will be increased modularity in the future, so that you do not have to buy all functions in one system. Instead, you'll be able to acquire smaller components

tailored to your individual needs. And as technological capabilities increase and as costs decrease, you'll be able to store increasing amounts of information right in your offices, right at your desks.

Because of the certainty of these advances, it is vital to put in place a system that can expand as technology expands, a system that is designed to integrate new technologies with current functions. In the long run, systems that can grow will save millions of dollars of taxpayers' money.

Today Fortune 500 companies are developing the criteria for integrated office systems. They are implementing comprehensive plans that improve their responsiveness to customers and that increase office productivity.

My single recommendation to the Senate today is to do the same, to investigate and implement an integrated office system. The benefits to the Senate and to the American people you serve will be great.

Thank you.

The CHAIRMAN. I am just looking at the witness list here. We have three further witnesses: Mr. Barbera, Mr. Seligman, and Mr. Ryan. I also have received a summons from the majority leader to come to the Senate floor. So perhaps—and I don't think we could take those three witnesses before lunch in any event—so perhaps this is a convenient time to adjourn or to recess for lunch. We will resume at 2 o'clock, and our first witness will then be Mr. Barbera.

Thank you.

[At 11:58 a luncheon recess was taken.]

AFTERNOON SESSION

The CHAIRMAN. The committee will come to order.

To avoid confusion, I will point out that the gentleman sitting on my left is not Senator Hatfield. He is Judge Sklar of Baltimore.

Our next witness, as previously announced, is Mr. Salvatore Barbera, chief executive officer of American Bell.

TESTIMONY OF SALVATORE J. BARBERA, CHIEF EXECUTIVE OFFICER, AMERICAN BELL

Mr. BARBERA. Mr. Chairman, I appreciate the opportunity to testify and I too intend to summarize my remarks.

The CHAIRMAN. Your full statement will appear in the record.

Mr. BARBERA. Traditionally, data processing and communications are viewed as a means for achieving specific business objectives, such as increased profits, improved cash flow, improved productivity, cost reduction, and customer satisfaction. Individual objectives are usually analyzed as self-contained entities and an application is developed to accomplish an objective.

This approach to information management on an application-by-application basis has resulted in systems and networks that are frequently separate and incompatible. In addition, these systems are often inflexible, difficult to modify, and incapable of easy incremental growth, creating barriers to data exchange and effective information management.

A network processing service should be designed to solve these and other business problems. It should be a shared, widely distributed, customer programable network, and a logical extension of evolving data processing environments.

Data communications, as we know it today, is the transport of information from one point to another. Such storage and processing resources as a host and minicomputers or intelligent terminals,

currently may reside at either end of the transport process. If one considers providing storage and processing resources at many interconnected service points located within the communications network, a shared distributed intelligent network is created.

Customer programability should be intrinsic to the design of this intelligent network. The ability to create customized data communications applications would make the new service in line with the fundamental philosophy of the third wave.

Processing within the network can offer a new alternative to be used in conjunction with traditional and distributed processing. It is particularly effective for applications designed and implemented in segments for execution on different, but cooperating, processors.

Since an intelligent network can extend the range of options for data communications and data processing applications, it is realistic to consider implementing segments of an application in the network. Such an approach provides the flexibility to achieve the most cost-effective balance between the storage and processing provided by central and distributed facilities and the storage and processing provided by the network.

Let us consider some examples of utilization of an intelligent network. First, consider preprocessing.

Preprocessing is defined as the modification of data which is input into an existing application without requiring changes to the application. One of the uses of preprocessing is to allow an individual to access applications and data in several different data centers. A program may be placed in the network to provide the connection to the desired application. Once the connection is made, the program provides a single interface between the individual and the applications accessed.

Network processing also can be used to provide compatibility among different types of terminals and computers. An intelligent network will make it possible for most computers and terminals to talk together with a single voice. Incompatible systems will be able to communicate.

The public nature and wide distribution of an intelligent network, together with device compatibility, the sharing and privacy controls that could be established, and the ability to preprocess and postprocess data would allow intercompany or agency data exchange to occur cost effectively and with minimal impact on existing applications.

Placement of processing capabilities within the network can provide additional advantages. For example, in the area of system design, network processing and storage can be distributed without the need to commit capital prior to the design. The final design of the application need not be committed before the application is trialed on the network.

The need for resources at distributed processing locations is reduced since users can utilize network resources provided at service points and pay only for the network resources used.

The reliability at remote sites can be increased without installing duplicate hardware since the duplicate resource can be provided by the network.

Security and privacy are key concerns to users of the public network. The authorization scheme of a shared network should allow

users to develop an environmental program and data that is as public or as private as they wish.

Data processing and data communications have become a vital business function. They have been and will continue to be used to help achieve the business objectives I referred to earlier. A widely deployed intelligent network is a new alternative in information management and has potential to change the way American and international organizations in both the public and private sector do business.

Thank you, Mr. Chairman, and I will answer any questions you may have.

The CHAIRMAN. Are you talking about available products, tested products that are on the shelf now, or are you talking R&D?

Mr. BARBERA. No, sir; we are talking about a product that is in the field today. As a matter of fact, we announced just 2 days ago our first commercial customer, TransAmerica, and it is up and working on the system. Of course, any system such as an intelligent network will have continued R&D, but it is deployed, up and working and has customers on it.

The CHAIRMAN. In the last few years, of course, your parent company, AT&T, has been in battle, and some of the battles have taken place on this battlefield on Capitol Hill. I have generally been supportive of AT&T, not on any elaborate economic theory or philosophical basis, but simply because from my observation as I have traveled around the world, you can make a phone call more reliably and efficiently in the United States than almost anywhere else, and I felt it was a proven product. I think the community has generally come to expect a certain level of support and reliability as far as AT&T is concerned.

Are you going to be able to maintain that level of reliability in new technologies, or do we get into a more shaky field?

Mr. BARBERA. There are two things working for us to maintain a very high level of reliability. The first is, of course, we are going to be working in a very competitive field and the customers would not tolerate anything that is not reliable. And, second, of course, the same highly qualified capable people that worked in the Bell System prior to this new venture are going to be working to do some of the same great things that they have done in the past.

The CHAIRMAN. Even in a competitive environment?

Mr. BARBERA. All the more in a competitive environment. If you are not reliable, no one will buy your product.

The CHAIRMAN. If you are not reliable, you will not be competitive.

Mr. BARBERA. Yes, sir.

The CHAIRMAN. We have talked a lot about standards. Do you conform to industry standards?

Mr. BARBERA. Yes. We talked about it and we certainly conform to what are the international standards. But we have the facts as they are given to us in the data field. You know, in the communications field, every telephone can talk to every other telephone. What we need is an intelligent network that would allow every terminal to communicate with every other terminal, no matter who the manufacturer was, no matter how dissimilar the device was, or

no matter what the protocols are, and that is the objective of this new service.

The CHAIRMAN. I am glad you came back to intelligent network because you must remember that my vocabulary on this subject is in a very preliminary state. I am learning.

Now, what is the difference between an intelligent network and a local area network?

Mr. BARBERA. A local area network again is a network that would be prescribed for a customer to perform a function for him, more than likely within a building, to connect his terminal, albeit some of them have been formerly incompatible terminals, but within the context of the building. It is still a network that will not be able to communicate without some gateway of facility to communicate with another. What we are talking about is a widely distributed public network that would allow private networks to communicate. The difference, of course, is, one, that it would be widely distributed, public in nature, and customer programmable. The customer would be able to put into the network—you use the network like a big computer and use the amount that he needs without buying a big machine and loading it up 50 percent and then going up from there.

The CHAIRMAN. So is it another way of saying the ability to acquire specialized services off a larger system?

Mr. BARBERA. Yes, sir.

The CHAIRMAN. Intelligent to the extent——

Mr. BARBERA. Intelligent to the extent that you actually write the programs that you want to execute. We do not guess what you want.

The CHAIRMAN. Are you familiar with the Senate system as it is today?

Mr. BARBERA. No, sir, but I probably have some colleagues that are.

The CHAIRMAN. I was going to follow that with asking you whether you feel that it is capable of the incremental growth about which you testified?

Mr. BARBERA. I would get back to you with an answer on that. I will submit an answer.

The CHAIRMAN. Any comments you have.

One other thing, I asked you about competitive environment, and I was really primarily thinking about competition between the various elements of the old AT&T Co., but there is another element to environment and that is international competition. Where is the principal international competition in this business?

Mr. BARBERA. Right now there is no direct competition from the international community. There are several countries, of course, that are very interested in subscribing to the service and becoming partners with us in an international venture. We are interested in developing our service in the United States, to get the full benefit of it for the United States first.

The CHAIRMAN. Is there fairly free worldwide competition in this industry? Can you sell in Japan, for example?

Mr. BARBERA. No, sir. I am sure you know, as well as I do, the difficulty that we find when we go abroad as contrasted to the openness that we have here in this country. We have been commu-

nicating with several telephone companies overseas, and the only way that we could actually sell this service in various points throughout Europe is with joint ventures with the local people. Otherwise, there is no way we could do business.

The CHAIRMAN. That is in France?

Mr. BARBERA. Actually it is England and Germany and Italy and Spain that we have had contacts.

The CHAIRMAN. You do not have any experience with France?

Mr. BARBERA. We have had no contacts there for this service.

The CHAIRMAN. And what about Japan?

Mr. BARBERA. With Japan, the irony is that it was not the telephone company that came over for dialog but two of the big holding companies. Each one wanted to get the system deployed within Japan for their own private use. That was the Japanese input.

The CHAIRMAN. Well, we are interested obviously in having a vigorous industry here as consumers, but the Senate also has other interests in this vigorous industry, and this spills over a little into another committee I head as chairman of the International Economic Subcommittee of the Foreign Relations Committee. So I have a dual interest, and anything further you would like to add to that—your thoughts on this particular subject—I would appreciate having; perhaps a statement at a later time if it is more convenient.

Mr. BARBERA. I think that would be very convenient at a later time.

[The material referred to above follows:]

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S. J. Barbers
Chief Executive Officer

December 17, 1982

The Honorable Charles McC. Mathias, Jr., Chairman
Committee on Rules and Administration
United States Senate
305 Russell Senate Office Building
Washington, D.C. 20510

Dear Senator Mathias:

I appreciated the opportunity to testify on December 8, 1982, before the Committee on Rules and Administration. At that time, you asked for comments on two outstanding questions.

According to my colleagues who are familiar with the Correspondance Management System, that system can utilize the versatility and incremental growth provided by an intelligent network. Using network capabilities, a Senator could cost-effectively access data bases at various locations and, if desired, process the information. Applications could be designed that would meet specific senatorial staff needs, and provide synergy between network capabilities and the existing Correspondance Management System.

With regard to the second question, as to whether there is open competition in this industry on a worldwide basis, some recent trade statistics are informative. In 1979, U.S. exports of telecommunications equipment totalled $388 million and contributed $149 million to the U.S. trade balance. Exports grew to $653 million in 1981, but contributed only $131 million to the trade balance because of rising imports of telecommunications equipment.

Foreign competitors have been very successful in the worldwide telecommunications market by following what appears to be a clearly defined strategic path. First, they develop their own domestic market - with significant support from their governments. This may take forms including subsidized financing, pooled Research & Development, government procurement contracts and the like, Second, while developing their own

domestic market, they carefully study the foreign market -- its needs, its potentials, its product standards. Third, armed with the strength of a highly developed market at home and coupled with an intimate financial partenship with their government and unrestricted internal information flows they move off-shore, often in joint venture with companies in the countries they seek to enter.

For example, the Japanese have captured some 40% of the worldwide market for certain semi-conductor memory chips, and the French are gearing up to invade the American market for data terminals to access electronic information systems by following this strategy. In its 1978 annual report, the Siemens Company of West Germany, after describing its continued growth in its domestic market, said: "We feel confident that step by step we will be able to penetrate the American market." Today Siemens' manufacturing plants in Florida produce special PBXs solely for the U.S. market.

Foreign governments help their companies in many ways other than those mentioned above. In Japan, the government will coordinate the development of technology by allocating parts of research and development projects among a number of companies and then encouraging them to work together on an intergrated basis. Also, foreign governments often provide more favorable financial treatment to their internationally competitive companies than does the United States. For example, a U.S. consortium that included AT&T and GTE lost a $1.8B contract in Egypt because the governments of the winners - Thompson-CSF and Siemens - would provide them loans at rates considerably more favorable than the U.S. companies could obtain from our own Export-Import Bank.

AT&T has continually supported the long-standing policy of the U.S. Government to promote free trade among nations. Whenever possible, negotiations to expand world trade to new products and services should be considered and methods currently employed by the U.S. to combat foreign-trade restrictions -- including diplomatic negotiations, government export promotion programs sponsored by the Commerce Department, and competitive financing arranged by the Export-Import Bank -- should be continued.

Salvatore J. Barbera
Chief Executive Officer

The CHAIRMAN. Thank you very much, Mr. Barbera.
[The prepared statement of Mr. Barbera follows:]

PREPARED STATEMENT OF S. J. BARBERA, C.E.O. OF AMERICAN BELL, INC.

Mr. Chairman and member of the committee, my name is Salvatore J. Barbera. I am Chief Executive of American Bell, Inc. I appreciate the opportunity to testify on the subject of network processing and some its' applications. Before discussing that subject, I would like to make a few comments on American Bell, Inc.

AMERICAN BELL, INC.

American Bell, Inc. Is a wholly owned, fully separated subsidiary formed by American Telephone and Telegraph Company to provide enhanced services and customer premises equipment. The formation of American Bell was a response to the Federal Communication Commission's decision in Computer Inquiry II.

The FCC, with the public interest in mind, permitted AT&T to enter the field of computers and data processing. The decision stated, in part, that all enhanced services (those where customers' information is changed or where customers interact with stored information) must be provided by a fully separated subsidiary. In complying with the decision, AT&T officially announced its new subsidiary on June 15, 1982. American Bell Inc. began doing business as of July 1, 1982.

NETWORK PROCESSING

Traditionally, data processing and communications are viewed as a means for achieving specific business objectives, such as increased profits, improved cash flow, improved productively, cost reduction and customer satisfaction. Individual objectives are usually analyzed as self-contained entities and an application is developed to accomplish an objective.

This approach to information management on an application by application basis has resulted in systems and networks that are frequently separate and incompatible. In addition, these systems are often inflexible, difficult to modify, and incapable of easy incremental growth, creating barriers to data exchange and effective information management.

A network processing service should be designed to solve these and other business problems. It should be reliable and available. It should be a shared, widely distributed, customer programmable network, and a logical extension of evolving data processing environments.

Data Communications, as we know it today, is the transport of information from one point to another. Such storage and processing resources as a host and mini-computers or intelligent terminals, currently may reside at either end of the transport process. If one considers providing storage and processing resources at many interconnected service points located within the communications network, a shared, distributed intelligent network is created.

This network should be physically accessed by customers using a variety of terminal and computer equipment and public or private circuits. It would qualify as an "intelligent" network since it would be designed to be programmed by the customer.

Processing within the network can offer a new alternative to be used in conjunction with traditional central and distributed processing. It is particularly effective for applications designed and implemented in segments for execution on different, but cooperating processors.

Since an intelligent network can extend the range of options for data communication and data processing applications, it is realistic to consider implementing segments of an application in the network. Such an approach provides the flexibility to achieve the most cost effective balance between the storage and processing provided by central and distributed facilities and the storage and processing provided by the network.

APPLICATION EXAMPLES

Let's consider some examples of utilization of an intelligent network.

First, consider the storage or a large data base of information. If the data base: Cannot fully utilize one storage device; Overflows one device; Or contains certain segments which are frequently accessed; Then parts of such a data base should be considered for storage within an intelligent network. The portion of the data base which is frequently accessed can be stored at a service point, or points, nearest the

using terminals. Such an arrangement reduces the cost and improves the performance of applications using these data.

For example, if a data base contains nationwide geographic information, yet a user frequently accesses information for a particular state, this segment can be stored in the network at the service point nearest the using terminals.

The pre-processing of information is another example of an application segment that can utilize network resources. (Pre-processing is defined as the modification of the data which is input to an existing application without requiring changes to the application.)

When a sales, purchase, or production order is entered by an operator, the order information is validated by a program placed on network facilities. Additionally, the network manages the operator interactive traffic; that is, using a store and forward facility, the network accumulates all transactions entered and them submits the entire "error free" operator entry to the host computer. The efficiency of the host is improved since it is not required to validate incoming data and is handling fewer transactions due to the network batching of entries prior to transmission.

Pre-processing could also be used to allow an individual to access applications and data in several data centers. A program may be placed in the network to assist an individual in attaching to the desired application. Once the connection is made, the program provides a single interface between the individual and each of the applications accessed.

Network processing also can be used to provide compatibility among different types of terminals and computers. Within the network, data transmission speeds can be altered, protocols translated, and code sets converted. This will permit dissimilar terminals and computers to communicate. This capability alone removes a major barrier to effective information management.

The public nature and wide distribution of an intelligent network together with device compatibility, the sharing and privacy controls that could be established, and the ability to pre- and post-process data would allow inter- company or agency data exchange to occur cost effectively and with minimal impact on existing applications. The ability to permit different companies and government agencies to have their data processing systems interact with each other, with the authorization of each party, would allow significant productivity gains to be achieved.

Placement of processing capabilities within the network can provide additional advantages. In the area of system design, network processing and storage can be distributed without the need to commit capital prior to the design. The final design of the application need not be committed before the application is trailed on the network.

The need for additional information resources at distributed processing locations, when system requirements exceed existing customer premise capabilities, is reduced since users can utilize network resources provided at service points and pay only for the network resources used.

The reliability at user locations can be increased without installing duplicate hardware since the duplicate resource can be provided by the network. User facilities are enhanced by the architecture of the network without users making capital investments in duplicate resources.

SECURITY

The authorization scheme of a shared network should allow users to develop an environment for programs and data that is as public or as private as they wish. If the inherent level of authorization provided does not meet a user's needs the appropriate level of authorization screening could be designed and programmed by the customer.

NETWORK MANAGEMENT

While users manage and control their programs and data within the network, the vendor should manage the network. The vendor should constantly balance and enhance the network to meet the high performance levels required.

Data processing and data communications have become a vital business function. They have been, and will continue to be, used to help achieve the business objectives I referred to earlier. A widely deployed intelligent network is a new alternative in information management, and has the potential to change the way American and International organizations in both the public and private sector do business.

The CHAIRMAN. Our next witness is Mr. Lawrence Seligman, executive vice president of Datapoint Corp.

TESTIMONY OF LAWRENCE SELIGMAN, EXECUTVE VICE PRESIDENT, DATAPOINT CORP.

Mr. SELIGMAN. Thank you, Senator, very much for the opportunity to appear here. I hope I can be of some use to this committee.

Let me identify my company. We are roughly a half billion dollar company involved in office and computer products. So basically this is the area of interest for this deposition—excuse me, this testimony.

We have a somewhat parochial interest in that we probably have the largest base of local area network systems today and quite a bit of experience with both products.

The CHAIRMAN. By the end of the day, I hope to be able to define area network system.

Mr. SELIGMAN. Well, why do I not take that on right now and try to be of some use?

Our industry in general uses a lot of buzz words and words that are not common English parlance and difficult to understand at times.

The CHAIRMAN. That is part of the problem around here. We do not like to expose our ignorance on this or other subjects so we do not stop and say, well, hold on and tell me what that means.

Mr. SELIGMAN. Well, why do I not take the opportunity to talk a little bit about it.

A long, long time ago, the telephone company realized that most telephone communication between individuals was primarily in the same town that the individual resided in, and that is reflected both in the way rates are charged and the way the system is actually constructed. Most times most people pick up the phone at home they are calling someone in their neighborhood. Most times someone picks up the phone in their own office they are actually calling someone in the same facility and in the installation of telephones the company takes advantage of that fact to reduce the total cost of equipment. The computer people have discovered that same phenomenon several times in the last 10 or 20 years, and we discovered it in a number of places. We discovered it in the way we constructed some of our computer systems.

For example, we discovered that when one piece of information was accessed, it turned out that another piece of information right near it would be accessed also, and we manage to build systems today that take advantage of that fact.

So once that discovery was made for very small incremental costs, we managed to run our computers two or three times faster than before. We are now discovering the same phenomenon in other aspects of computer systems, and this is where local area networks come into play.

Local area networks basically provide for very high speed interchange of information among a group of computers or terminal devices, much higher speeds than typically provided over typical telephone connections. Given the cost of wide area transmission, it is not feasible to provide that great speed over long distances. However, it is possible to provide that kind of speed over the short distances that would be involved, let us say, in a campus setting or within the Senate Office Buildings. So that by lower speed commu-

nications for long distances and higher speed communications for shorter distances, we can give users the benefit of higher speed communications without incurring an extremely high cost of benefit. So that we as an industry can put more functional systems in people's hands and make use of high-speed communication without having to incur that cost and, say, rebuild the whole U.S. communications system.

There have been a lot of products that have been introduced that take advantage of that and these are called local area network products.

Does that help, I hope?

The CHAIRMAN. Yes, I think so.

Mr. SELIGMAN. It is the general concept of locality and takes advantage of the cost to do that.

By way of talking of buzz words, I would like to reiterate something that Mr. Olsen said. We are not talking about automating anyone's job per se. We are not talking about the automation that one thinks about in the industrial automation that certainly has struck the country over the last century. To some extent we are automating some clerical functions. We are making certain of those activities more productive in a direct cost measurable way, but when we go and analyze the cost we save, we typically find we save about 10 to 15 percent of a secretary's time by putting extensive word processing systems in place, and the cost of the equipment to do that is, generally speaking, far in excess of that actual hardware saving that accrues from installing that equipment.

So either in the systems we have installed today, which have been fairly limited in functionality, as an industry, we have not saved a great deal of dollars for industry nor have we greatly automated a lot of functions. But we have been able to provide a number of elements of functions, things that people can now do that they could not have probably done before.

In a law office, for example, the requirement to type and retype long contracts would make contract negotiations take a lot longer. Now, we know that changes can be made very simply and the rest of the document that was not changed would not change, and no typos would crop up.

So we are doing things now that we could not have done before, rather than strictly saving money. In our products we do not make a large cost justification based on replacing work elements. We would, rather, show our clients, and I think our competitors do the same, the kinds of things they can do now that they could not do before. And the kinds of new things we are talking about I think are somewhat mind boggling.

I think when we look back on all this, 20 years from now, we are not going to be talking about strictly evolutionary changes in our industry, but I think we are really going to be talking about an information revolution. There is fairly significant changes in our ability to handle information in an increasingly complex world and our ability to view that information in ways that we have not been able to view it before.

We, as a society, have been storing information in various kinds of records for all of recorded history. Libraries back in ancient Egypt had books in them, and recorded grain transactions. But the

problem of our paper based system, while they are very effective in storing information, they are not terribly effective in allowing people to find information that is stored. That is, unless you know specifically what you want, it is a fairly laborious task to go through that information and try and sort out what piece of it is really of relevance to you at the time.

By putting that kind of information in the computer, we could ask the computer to do the laborious task of searching through all the information, sorting through it, and finding those pieces that are relevant to what we are interested in, and present them in a concise fashion.

The CHAIRMAN. Let me stop you right here. I do not want to interrupt your statement too much, but that brings up a question.

Some years ago we were interested in how many references in law there were to the subject of national emergency, and we borrowed an Air Force computer and we scanned all of the statutes, the Acts of Congress, for the words national emergency, or state of emergency, or state of war, similar words, and we came up with nearly 600 separate statutes that make that kind of reference.

Now, what do you have to do physically in order to make that search? I was told it was done. I accepted it at the time it was done, but how was it done?

Mr. SELIGMAN. Well, depending on when it was done, it was a fairly straightforward——

The CHAIRMAN. Put it in the state of the art today.

Mr. SELIGMAN. There are basically two approaches. The first is an approach which essentially scans the records word by word.

The CHAIRMAN. But somebody has to manually type that in?

Mr. SELIGMAN. Yes.

The CHAIRMAN. How long would it be before we could scan a page and——

Mr. SELIGMAN. We can scan pages today. There are products which will take typewritten text and automatically input them into a computer system. We have systems today that can take stenographic input and create texts directly.

The CHAIRMAN. Without retyping it?

Mr. SELIGMAN. Without retyping it. Further, to the extent that that information is captured in an online system, that information can be—is in electronic form. I think one of the previous speakers mentioned that most newspaper information is in that form, and now services are offered in that form.

The CHAIRMAN. I would assume most all printed material is.

Mr. SELIGMAN. I do not have the statistics, but I would think that virtually all printed material today is in fact created using computerized equipment. There is a technology today that speeds the process of searching through information. When that information is first created, search indices can be maintained which greatly reduce the time to scan all the text in order to find the kinds of phrases which you described.

So that if, for example, 2 or 3 years ago, when one wanted to undertake the task of finding the phrase national emergency, in 10,000 pages of documents, that task would probably take on the order of days. With today's technology, it is possible to do that in the order of minutes, or perhaps an hour, or so, and that is because

we have found a lot of information on how to structure the information in the text so that we can more rapidly go through it.

I hope that satisfies your question.

The CHAIRMAN. Yes.

Mr. SELIGMAN. I think, in the example that Senator Hatfield discussed, that kind of ability to search through a large amount of text, for example, the previous letters in the last 6 months, from his constituents, against a new activity such as a change in social security, would make it possible for him to electronically look at the letters that have been generated, and to find those letters which were of interest to him in creating that type of response which he discussed. One can buy those kinds of systems today. Although they are probably not as widely deployed as they might be.

I would like to follow up on that by stressing the importance of not just collecting information, and having it available on a typewriter, but to be able to slip that information into a very useful form. Often, for example, graphical presentation of some data is of more value to the person examining the data than is a tabular form of data. Often one can look at graphics and trends much more clearly by looking at a chart than one can by simply attempting to scan a pile of numbers, and one of the things that computers ought to be able to do for us is basically extend our capability to do the one thing that humans do well, which is to extrapolate information from the past into the future, and the thing that facilitates that is putting the information in a form that we are comfortable seeing.

I can give you an example. About 15 years ago I was working for a company, and we had a problem with the computer. It was not doing its arithmetic correctly, and we were not sure why. It was doing on the order of 1 million calculations a second. It was failing once every few minutes. For us to have been able to manually give it millions of calculations to do, and checking them ourselves was a virtually impossible task.

What we wound up doing was asking the computer to draw a number of graphs. We asked it to draw circles, hyperbolas and by just looking at a curve and seeing some point is out of place, we essentially, at one glance, could find the problem, and could as a result look at the million calculations and determine whether there was an error.

I think that is a particularly strong example, but surely, having not asked for that information in that kind of form, we would not have found the answer to the problem.

I am not attempting to go through my testimony as presented, but I am trying to address a couple of issues that I think have come up in the rest of the testimony, and what I would like to do at this point is to take on the issue of standards sort of head on, because I think it is an important one.

When we are talking about standards, we are talking about two needs. One is some need for the industry, and the other is need for the Senate as it looks to procure equipment for itself.

I would like to reiterate what Mr. Olsen said, but perhaps a bit stronger, and I would not want to be construed as being against standards. In fact, our efforts have been made to conform to standards where they are applicable, and that applies to both standards

that are officially set by either regulatory or industry body, or standards which are de facto standards.

As one of the smaller companies in the industry, we find ourselves constantly interfacing with other people's equipment, and need to conform to it, whether it is part of a standard or not. I basically believe that we are awful early in the days of office automation, to go too headstrong in the establishment of firm standards.

That is, I do not think we as an industry know enough yet about the kinds of products and services we need to offer, about the communications vehicles we would like to facilitate, to rush too quickly into standarization. I think it is very important that we continue to innovate as an industry. I think we have done a very good job of that in the past, and we need to make sure we continue to do that in the future. If we rush too headlong, too quickly into too many standards, we may find ourselves being precluded from the innovations that I think have made our industry so dynamic. That speaks to the industry.

To speak to the Senate specifically, I would like to make a suggestion, and that is, in looking for equipment and services for itself, that it attempt to set requirements in as general a context as possible.

I have the opportunity to review many requests for proposals from various of our customers, potential customers, in this business, and we often see a request for a proposal that has some specific requirement in it, a printer that prints at 57 characters a second. That is a very blatant example of something that is akin to a standard, where in fact the justification for that number is probably pretty slim. Essentially two digits of precision is not something we know how to deal with today.

So as the Senate goes about its business of procuring equipment, selecting among various vendors and services, I recommend that it make sure that it examines the various possibilities that are available to it, and does not set up a requirement process which will narrow that down in scope, and the Government does in fact have a procurement vehicle available to it that will facilitate that kind of activity.

A lot of the issues of improved telephone communications, improved electronic message services, have been discussed, and it would be somewhat redundant of me to proceed on that.

I would like to raise the point, however, that in the process of selecting equipment, one thing you should consider pretty hard is some of the other things that one may want to do in the future. I for one am becoming enthralled with the concept of video conferencing, the ability to essentially sit face to face with someone that may be across the hall or across the country, and carry on a conversation with that individual.

The CHAIRMAN. It could change the whole character of congressional hearings. Witnesses could testify from their own offices.

Mr. SELIGMAN. We could conceivably do that, and certainly there are aspects of telecommunications that could be facilitated by being able to look at another person in a conversation. We convey a lot of information in our facial expressions, in our demeanor, and in the way we act when we are communicating.

Both the telephone and electronics message services are very simple personal things which use a great deal of that communication. The implication of that requirement as a future item I think is fairly strong, and I think speaks to the advantages of local area networks as a vehicle for the implementation of the kinds of systems that we are talking about.

Local area networks, much like cable TV, provide the ability to deliver not only text kind of information that they are currently delivering, but also television kind of information that would facilitate that kind of face-to-face communication, and the local area network solution, as opposed to a more general solution, is required, because we as a nation cannot afford the amount of work required for video telephones on a national basis.

So that certainly locally, that is, within a campus environment, or any place that we are capable of running cable, we can ensure face-to-face communications, without the requirement of people traveling to the extent we are willing to pay the bill, albeit a fairly high bill today, we can have that kind of face-to-face communication over a broader area.

The Senate also, I think, should carefully consider how much it is going to be changing systems once installed. I am not familiar enough with the requirements here, or the procurement procedures here to comment on it specifically. We talked about a fair degree of convertibility. I would simply like to make the point that if you are considering installing a system which is going to have to have a lifetime of several years, that lifetime is probably larger than the generational change that we in the computer business have been delivering. We typically change systems on a fairly substantial basis, on a 2-year basis. Rather than be exceedingly conservative, one should look at taking a somewhat more aggressive position to the set of requirements that one has, so that the system one puts in will be sure to be expandable to meet that set of requirements over the next couple of years. That basically says that future expansion is a really important capability. New office automation equipment and capabilities are being introduced at an increasingly faster pace.

I would like to talk about the rate of explosion, rather than the rate of expansion. We talked earlier about the requirements for desk top computers. I think in the next couple of years what we are going to find is not——

The CHAIRMAN. I am glad you decided to adopt the Senate nomenclature.

Mr. SELIGMAN. In the next couple of years we will be talking about briefcase computers, and in fact, if things go as they have gone in the past, those briefcase computers are going to probably cost less than the briefcases that carry those computers. One can buy a computer to carry in a briefcase now for under $100. It does not do quite enough, but there are some products that are being developed that are in that category.

So the product there is cheaper than the briefcase. We will find lots and lots of people using that, whether it is individuals, or part of an integrated system.

In summation, while this has been a brief overview, both our areas of interest are very complex. In a given day we have lots of

communications, both verbal and written. We access lots of information. We analyze that information. We project from that information, and we use probably our greatest resource, our minds, in doing all of it. It is very, very important that we make sure that the equipment we buy has the maximum value it can to enhance our best resource, and that is to extend our own intellectual abilities in handling that information.

The first step is the hardest. That is defining what you need, and looking for a system, and vendors that can meet those needs, and grow with your needs in the future. In order to address office productivity and meet the challenge of the competitive nature of the business world and the political world, we need to take positive moves toward the installation of these systems, and systems which are well integrated.

For a long time, a lot of the products have been approached on a piecemeal basis, or problems have been solved one at a time, and independent of each other. The technology of office automation is capable of furnishing totally new facilities for our use, and by taking a systems approach, we can accomplish that policy.

I would like to thank you for the opportunity to testify, and answer any questions you may have.

The CHAIRMAN. One question again, which is not related primarily to the procurement or expansion questions that we have before us here in the Senate but which relates to the Judiciary Committee. You are talking about the availability of scanning equipment and how it will be increasingly available as more and more printed material comes through already coded. I am interested in the copyright implications of scanning and usage of public material.

Have you given any thought to the problems you are creating for patent and copyright lawyers, and the headaches you are creating for us in the Judiciary Committee, to try to apply the constitutional protections of copyright to this new technology?

Mr. SELIGMAN. We have created quite a few headaches, both for ourselves and the Congress in that regard. We have the still open issue, I think, of software copyright, and software copyrightability, which I do not think has been fully addressed. Plus the more traditional copyright problems being applied to documents.

I think, though, we will see dissemination of material, not only in printed form, but electronic form, by the publishers, so that perhaps some of these problems will not be as great, to the extent that publishers can make this material available in electronic form, as well as available in the printed form.

The problem is somewhat resolved itself. The technology is still such that massive reproduction on high speed equipment, such as computer printing presses, in the case of printed material, or in the form of laser disks, laser optical disks—those printing costs are lower than copying costs, on a one-by-one basis. So to that extent, the problem will resolve itself when the publishers make their material more available in the electronic form.

But certainly, with the invention of the copier, our industry has created numerous problems in that regard.

The CHAIRMAN. One thing that is difficult for me to understand is how and why telephones and computers share the same cables and PBX's. Does this have to be? Is it a necessity?

Mr. SELIGMAN. I guess I would argue that in the long term it is probably not a good idea, the wiring we find in buildings today, which is multiple wires bound in a cable running into the basement into a central exchange, is a fairly antiquated way of doing it. The technology has progressed to the point where we do not need to be quite as dependent on a technology that basically evolved during the turn of the century, the last century.

The CHAIRMAN. Then why do we do it?

Mr. SELIGMAN. Because we have an incredible installed system. Virtually every building in the world is wired for telephone service. The computer industry is attempting to piggyback on some of that to reduce the cost of putting the equipment in place.

I think we will find with newer office buildings, wider band width cable, such as supporting local area networks, and coax cable. Essentially it is a cable TV installation. Putting in that kind of cable TV technology will allow for both voice and phone data to use those cables, and have the properties I talked about earlier. That is, it is much faster. We will be able to attach computer devices to each other, and allow them to communicate at much faster rates than we have had with the installations that have been in place since 1900.

The CHAIRMAN. Going back for just a second to this local area network, could you conceive of each Senator's office as a local area network, or would you conceive of the Senate system broadly, as a local area network?

Mr. SELIGMAN. The primary issues are not only cost issues, but also security issues. The Senate, its staff, form a community of interest. That community of interest wants to be interconnected and share information. That sharing of information can occur over a local area network, and once again, we are talking about the locality phenomenon, that is the information you share with your staff is probably a lot more verbose, that is, a lot more of it than the information you share with other Senators.

So that one can think of a hierarchy of networks. That is, one for yourself and each of the other Senators independently, all connected together within the Senate campus, for Senators together on those issues they need to be connected on.

So the answer to your question is both. That kind of system as was discussed by some of our previous speakers can allow for great new ways, that is, the connection to your existing Senate system. The system you currently have in place can be connected to those local area networks, and can be utilized by the kinds of stations that are placed on the local area networks, so that existing systems would not have to change in any form in the installation of new equipment.

The CHAIRMAN. Now, as we move these services into offices, hardly a week goes by when I do not hear someone say, when am I going to get this piece of equipment in my office. As it moves into offices and out of computer centers, somebody has to be trained to run the machines. Are we going to have to get up a Senate school, or is the industry capable of doing this?

Mr. SELIGMAN. I would hope that the industry learns to make a lot more of its products a lot easier to use. We have made some steps in that direction, but I do not think we have made enough.

I can give you some specific examples. In the area of financial calculations, the personal computer industry, for example——

The CHAIRMAN. Examples of things not made simple enough; you do not need many examples for me.

Mr. SELIGMAN. One of the best selling software packages is a financial analysis model, and that is for people who are not computer trained, to build financial models, and to build them by throwing in different assumptions. That is an area where we have made some good progress, and I think we will continue to make progress.

The fact that there are 2 million personal computers is a tremendous incentive for developers of software, to develop computer software which is in fact friendly and easy to use. So I think we have the seeds in front of us for making that easier.

I personally saw installed a system of one of our competitors, word processing equipment. The equipment was delivered without the benefit of anyone from the manufacturer showing up, in boxes with sufficient information, and sufficiently well executed, that the user of that equipment was able to unbox it, connect it, and begin typing letters, without a single moment of formal introduction, all within the same day, and I think that is another example, unfortunately, not one of my company, where it can be made to work well, and I think that you—in making the equipment a lot simpler to use.

The fact that the equipment is cheaper to produce broadens the market, and increases the incentive to make that happen. It also puts more computer power on the desk, which is more capable of dealing with people in the form that these people want to be dealt with.

I personally feel, and I guess it is an opinion, I guess it is hard to prove, that you will see increasing friendliness of the equipment, both from the competitive standpoint and from the standpoint of the ability of the industry to produce that kind of product at a reasonable price.

The CHAIRMAN. Considering the fact that there is a certain volume and scope of information which is now available to Senators' offices, how would new computer services take advantage of the existing systems?

Mr. SELIGMAN. There are basically two ways to do that. The first is the fact that the new systems will allow more people to be able to access the existing system. That is, your existing system as it works now, in the future will be able to continue to work pretty much as it is, only the interface between it and the person may in fact be different device on the person's desk.

We have the capability today within the industry of delivering that kind of capability. However, I think there is a major step coming, and that major step is the ability of a program on your desk in your computer, in your desk top computer, working in your behalf to analyze some of the information that is coming to you, that is available to you.

For example, if you are really interested in seeing information in a graphical form, instead of a straight tabular printout form that the current system provides you, you will be able to get that information presented to you, in a graphical form, rather than a tabular form, so that working in your behalf analyzing the information

that is available to you is a computer program which will make it easier for you to access that information, and to draw conclusions upon examining it.

The CHAIRMAN. There seems to be a trend toward standard computer operating systems. The small business systems seem to be progressing toward the CPM operating systems, and the larger systems seem to be migrating toward the UNIX. Will these ultimately emerge as standard systems?

Mr. SELIGMAN. Yes, I think they fall into the area of de facto standards. Neither of those particular products—in fact, these are products available for sale—that can solve everyone's needs universally. They both have their areas where they are good. They both have their areas where they are not so good, and they both have their areas where they are awful. But both are useful, and I think you will find most of the vendors adopting an attitude toward those operating systems that say, we will be in some reasonable way compatible with them, so that someone, for example, that has a program which they wish to run in the CPM environment will be able to run it in the CPM environment without changing it.

So in my parlance, it falls in the category of de facto standards, part of the real world that we and others as vendors need to address, and to deal with, and the way to deal with it, since they are so popular, is to make it possible for people who want to use them, to use them on our equipment.

The CHAIRMAN. Let me just ask you one final question.

Where does your competition come from? Is it all domestic competition?

Mr. SELIGMAN. We appear to face competition from everyone in sight. The primary competition is from the United States and from Japan, who are the primary vendors of the equipment now in our area. There are a number of United States companies, both larger and smaller than us, that have a variety of products, and there are a number of Japanese companies that appear to be interested in entering the United States market in great strength.

In specific countries in Europe, for example, we compete with indigenous suppliers that have established track records.

The CHAIRMAN. How about within the United States?

Mr. SELIGMAN. Within the United States today, domestic competition is the primary competition. However, the rate at which foreign competition, particularly the Japanese, has been increasing, is very considerable.

The CHAIRMAN. Have you penetrated the Japanese market?

Mr. SELIGMAN. We have a very small penetration into that market.

The CHAIRMAN. Would you like to have a larger share in that market?

Mr. SELIGMAN. We would love to have a larger share of it, sure.

The CHAIRMAN. And what about Europe?

Mr. SELIGMAN. We do pretty well in Europe. Once again, it is very dependent on the market segment you are talking about. In the distributed data processing market, where a company can make a decision on its own what to buy, there is quite a bit of what I call free competition.

Our telephone products, that is, equipment we make to expedite telephone call handling, we specifically cannot sell those products in the rest of the world, because the industry is government-owned, or government-regulated to the extent that we have not been able to penetrate it. It is only recently in the United States that we can sell some of these products. The United States has moved far faster to the deregulation of communications and telephone industry than has the rest of the world.

My feeling is, based upon a lot or entrepreneural experience, that the way one gets innovation and better products is through the kind of competition, and through innovation, and the more regulation that is applied, the more difficult it is to do that.

Some of my colleagues, none of whom have testified here, have made the analogy to the automobile industry. If you took 1965 as a base year, and you say, apply the rate of improvement of technology in the computer business to the automobile business, you would be able to go buy a car for a couple of hundred dollars, at a couple of hundred miles a gallon. That is because of the competitive nature of the industry, and the freedom from regulation.

The CHAIRMAN. Well, you have given us a lot to think about, and we appreciate it very much.

Mr. SELIGMAN. Thank you for the opportunity to appear.

[The prepared statement of Mr. Seligman follows:]

PREPARED STATEMENT OF LAWRENCE SELIGMAN, EXECUTIVE VICE PRESIDENT, OFFICE AND COMPUTER PRODUCTS, DATAPOINT CORP.

As you are probably aware, the information processing industry is pervasive with "buzzwords" which describe the many products and concepts that are unique to what we do. In its own right, Office Automation has gained popularity as a buzzword denoting the automation of business functions. While Office Automation definitions may vary on specific points, and are keyed to the offerings of different vendors, the benefits they provide are of primary importance to the Senate.

OFFICE AUTOMATION OBJECTIVES

The essence of Office Automation is perfecting the most efficient way to handle, manipulate and communicate information. And in a world characterized by ever increasing complexity and time pressures, Office Automation functions must enhance the user's ability to digest and evaluate large amounts of information in a timely manner.

We truly are becoming an information society in which our ability to compete, position and react is directly proportional to the accuracy and timeliness of our information. Office Automation can provide access to this information, through a variety of disciplines, in numerous formats and on a broad basis so that people can enhance the quality and productivity of their work.

OFFICE AUTOMATION AND THE SENATE

In the context of this concept of Office Automation we can generalize some characteristics of the Senate as an Office Automation user. The Senate and Senate staffs require some unique information processing needs as well as some that are common to many businesses.

Unique to the Senate are the large number of users who are co-located but have different information processing needs. A Senator, Senator's staff and Committee offices all represent communities of interest within the Senate. Much information will certainly be shared by all, and yet some communities of interest will maintain information which is confidential or unique to their needs.

Due to the volumes of research and information which are associated with every piece of legislation, a Senate Office Automation system will also require considerable text processing, data storage and communications capabilities.

Many of these tasks are the same as those performed every day in businesses all over America. The intensity of tasks and volume of information processed are primary variables. Both the Senate and American business have a constantly expanding need for speed and accuracy of information. The information must be available in a variety of formats and to the people with the most immediate needs.

Just as in many businesses, Senators and Senate staff members fit into different areas of the information flow. The Senator sets the tone and style for his staff and is the ultimate decision maker. The Administrative Assistant ensures that the Senator's staff work is maintained at a consistently high level and that work flows smoothly. Legislative Assistants and Press Secretaries handle day-to-day office operations and contribute input to the staff's decison making processes. Finally, clerical workers provide much of the correspondence which occurs outside of the staff itself and handle everyday office tasks.

All may need the same information and yet each may require it in a different form. Legislative Assistants, Press Secretaries and Clerks may compile, edit and produce a great deal of information on a specific subject. Senators and Administrative Assistants might need the same information produced in a much more condensed format.

OFFICE AUTOMATION NEEDS

While this speaker is not a Senator, common ground exists between the information processing needs of the Senate and a business. Excellent communications capabilities are of paramount importance whether referring to face-to-face, verbal or written contacts.

In this day and age, many of us use the telephone in the majority of our communications. We do so because it is extremely immediate. We can handle business quickly and effectively with a phone call. Sophisticated electronic telephones can provide teleconferencing, automatic dialing and numerous other features which enhance our ability to be more productive.

The ability to communicate on a face-to-face basis is critical to both Senators and executives. The personal nature of the face-to-face discussion is something which cannot be duplicated with a phone call or written correspondence. It is in this area where videoconferencing can play a role in increasing productivity. Often the physical time it takes to get together exceeds the length of the meeting. Videoconferencing provides the warmth and personal touch necessary and yet is immediate enough to be an effective use of our time.

The message has long been an effective method of communication, and it is taking on a new meaning with today's voice and electronic message systems. Such systems allow us to specify a variety of delivery methods and parameters. They can even require that the recipient send an acknowledgement of receipt before the message can be accessed. As a result, automated message systems can help eliminate the irritating and time-wasting problem of telephone tag.

ADDITIONAL CAPABILITIES

In addition to efficient and flexible communications, Senators and their staffs need quick and easy access to information in its most usable forms. Office Automation systems today can allow the entry of a single word or group of words and provide a listing of all relevant information. Reams of statistical data can be automatically processed and reduced to a pie chart or bar graph by available graphics systems. Financial modeling packages can allow Senate staffs to perform budgetary and financial projections with a variety of assumptions and flexible presentation formats.

Such capabilities can significantly enhance our ability to use information. Combining such capabilities into an integrated system allows even greater functionality. A practical example is a present Datapoint client which uses a local network to connect various office automation equipment. Through office workstations, a financial modeling package is used to produce historical data and projections of financial information. Once the information has been organized as desired, it is automatically forwarded to a business color graphics system. Charts and graphs are then created from the financial data for use in a variety of presentation formats. In large executive conferences and board meetings the client transfers color graphs directly to a large video projection screen. This fully-automated electronic slide presentation can also produce 35mm color slides, color overhead transparencies and color prints.

THE SYSTEMS APPROACH

As was stated earlier, a general concept of benefits should be common to all office automation strategies. Increased productivity is essential. So are system flexibility and the ability to use the same equipment for multiple office functions. This suggests the need for a systems approach to office automation.

Without the systems approach, separate pieces of equipment are used to perform separate functions. In such cases none of the equipment is fully and information resident with one machine is not easily transferable to the others. Just as the systems approach is important to efficient communication, a central database capability means that people working on different equipment will be working with the same facts.

Integration of office automation systems, then, is essential from a functional standpoint, an applications standpoint and from an equipment standpoint. The investment cost in the equipment that is needed to automate office work is significant and multi-functional approaches must be employed to make office systems as productive and cost-effective as possible.

BUILDING A SYSTEM

Networks provide an ideal medium to move information throughout Capitol Hill. Local networks allow an arbitrary number of functionally, as well as physically dispersed processors and peripherals to be linked together. They can provide shared-use databases, high-speed data movement, integration and the sharing of expensive office automation hardware. Local networks can also provide gateways into the extensive information processing systems presently used by the Senate. Regardless of the type of wire which provides network interconnection, software is the essential ingredient that facilitates communications and information flow.

An individual local network can be used to serve each Senator's staff with additional networks implemented as database resources for general Senate use. All Senate networks can be tied together to allow common access, yet each Senator can exclude from access any confidential information desired. Cable can often be placed in conduits with telephone wiring, and wall outlets for attaching network workstations can be placed virtually everywhere there is a telephone.

Once wiring is installed, each member of the Senate and senate staff can be provided with a workstation capable of performing word and data processing, electronic message services, and numerous other functions. Whenever necessary, other functions can be added to any part of the network without affecting other users. A laser printer can be placed in an area where updating and disseminating timely information is a critical concern. Graphics systems and access to remote telex and teletype networks are other incremental functions.

An important consideration in implementing these capabilities is to provide for future expansion. New Office Automation equipment and capabilities are being introduced at an increasingly faster pace. Telephones are being merged with workstations and optical discs offer the promise of unlimited and inexpensive data storage. Videoconferencing is becoming cost-effective enough to be taken out of specialized rooms and placed on the executive's desk.

Because of such rapid advances, systems installed today must be flexible and modular enough to take advantage of tomorrow's capabilities.

BEGINNING OFFICE AUTOMATION

Once Office Automation needs have been established, a workstation approach should be utilized to provide network access wherever required. By using common hardware and specialized software, functionality can be added in the most economical and practical manner. As a result, systems need not become obsolete as technology provides new, more productive ways of automating office functions.

In summation, while this has been a brief overview, my business and yours are both highly complex. In one day we talk, write, acquire information, analyze and project from that information many times. We achieve this all with one basic system—our minds. We constantly have the need to express this information in different formats—through numbers or words, verbally or in writing. While office equipment can't replicate a human mind, it can be constructed to work compatibly with humans—and that is the goal of most Office Automation vendors.

The first step in Office Automation is the hardest, defining your unique needs and looking for a system and vendor that can meet those needs today and grow with your needs in the future. In order to address office productivity and meet the challenge of competition, a positive move must be made toward the integration of office

automation systems. For too long the problems have been approached on a piecemeal basis—solving them one at a time and independently of each other.

The technology of Office Automation is furnishing totally new facilities for our use. By taking a systems approach, we can maximize the potential which technology offers us.

The CHAIRMAN. Next we will hear from Robert Ryan, president, Dialcom, Inc.

TESTIMONY OF JONATHAN WEINBERG, DIALCOM, INC.

Mr. WEINBERG. First, let me apologize. Mr. Ryan could not make it at this late hour. He asked that I submit his testimony and make this presentation.

I brought with me Valerie Vincent who is an account representative and an expert in the service that we provide in the House of Representatives, and she will be able to assist me in answering questions that you may have specific to the business that Dialcom conducts in the House of Representatives.

I would also like to summarize——

The CHAIRMAN. Let me say that you may be the person most responsible for this hearing because it is very often the former Members of the House who come to the Senate who have been accustomed to using your services in the House of Representatives and have raised questions about whether the Senate system is as good as it ought to be.

So we blame you.

Mr. WEINBERG. Well, we are very proud of the system we developed for the House of Representatives and we do think it has a lot of application for a system like that in the Senate, and we are very thankful to you for asking us to come here and share our experiences with the Senate.

I would just like to summarize the written testimony.

The CHAIRMAN. Your full statement will appear in the record, and if you could summarize it briefly, then we will discuss it.

Mr. WEINBERG. The first paragraph of that testimony reads:

One of the greatest challenges to the computer and office technology industry has been to provide systems that can be specifically and easily used in a nontechnical environment. On Capitol Hill, our industry must also address the specific and unique requirements of a congressional office.

I think that is the key to what we would like to talk about today, and that is both what the industry and the technology is doing today and tomorrow, as well as how that technology is and can be used in the Congress of the United States.

Dialcom, as you may be aware, is not a hardware company. We are a software company. In the midseventies we were asked by a Member of the House of Representatives to come down and would we be interested in helping him write some computer programs to process his correspondence. Very briefly, we looked around and saw there was a real need, and we started out with three programs that we wrote. Today Dialcom has 240 congressional offices that use our service every day to handle their correspondence. We are the largest single vendor of computer services in the House of Representatives.

The reason for our success in the House and in the general sense for all the products that we offer is, first of all, they address them-

selves to some very unique needs. The House of Representatives and the Senate are not unlike other offices that need office automation technology. However, you have some very unique problems and ways of doing business that really require a very customized system that is modeled along the line of the type of work you do here, and that is one of the things that Dialcom has developed for the House of Representatives.

Also, all our products are designed for the nontechnical user. We determined many years ago that people should not have to write programs in order to do the type of work that they are hired to do, and we essentially set up ourselves as consultants and experts for the House of Representatives. People that needed to process the correspondence could do just that, and did not have to be computer experts.

Also we realized very early on the need for services and support. Dialcom feels that in the decade of the eighties, service is really going to be the key to doing business. There are a lot of good products on the market. Technology plays a large part in this. The key to making these products usable is the software that drives them as well as the service that the companies that are providing for these products and the services they are able to supply.

Dialcom, from the very beginning, has always had a policy if anybody had a problem or a comment or a question, they could call us up at any time of the day and talk to us. This was very important. There was this personal communication, and the ability always to get help when they needed it and a person to talk to.

Our software is what we consider evolutionary. We did not go down with a product that was already developed and then modify it for another application and say here it is, this is how you must use it. We essentially developed our software based on what people asked us to do, as well as what they thought the computer should be doing for them, and, therefore, it addresses the needs of the people that are using it very, very specifically. All these things have really contributed to the successs of our service on Capitol Hill.

We also started with thinking about what were the most significant things that a congressional office had in the way of problems, and we started from the most significant and then worked down from there. The most significant problem we thought was the handling of the daily correspondence for the vast amounts of mail that were received. We wrote programs to do that. And then people said what can you do about all this filing? Then we developed a numerical filing system that has been very, very successful, and it has revolutionized the filing system in the House of Representatives. From there we moved on to such things as project tracking and casework tracking and various statistical reports to help Members analyze the important issues in their district and certain areas and so forth and so on.

This was a policy that was consciously followed by Dialcom, both on the Hill and off the Hill.

In addition, we became interested and started servicing the general segment of the business community in terms of office automation. In the business world, the most significant application of computers in the office environment we have found is electronic mail.

Today Dialcom is one of the leaders of electronic mail products in the world. We have the largest number of users of electronic mail throughout the world. The House of Representatives is also using our electronic mail service as are various other agencies in the Federal Government and, of course, private industry. That service is being offered by House Information Service procured through Dialcom.

We also have offered UPI News Service to the House of Representatives as well as the commercial environment. What we have is UPI news wires feeding our computers, and every story is keyword indexed and put into a data base. This allows people to do research on stories that come across the wires with a very, very fast search, looking for either a Congressman's name or a topic that perhaps is of interest to a committee he serves on.

Those are some additional applications other than our correspondence service that are being offered on Capitol Hill.

In industry today, Dialcom is offering these kinds of products as well as several others that either have not—not yet become important for Capitol Hill, or do not really apply. One is various word processor interface packages to allow people with various vendor's word processors to communicate with each other, quite often through electronic mail. One of the previous questions was about the need to have networks do the protocol conversions to allow different machines to talk to one another. This is very, very important and we are doing that on one level.

Also we have written interfaces into the Western Union telex system so that a person on Dialcom cannot only communicate with electronic mail but can send a telex to anybody in the world, and we are also interfacing with the Postal Service's ECOM system. We are presently developing software to interface our congressional system with ECOM, so that a member of the House of Representatives that wants to send followup mailing does not have to have the letters printed in his office. He can actually generate the mailing send it electronically, it is received by the local post office, and printed locally and delivered by that local post office. This is a product we expect to be offering very, very soon.

We have done a tremendous amount of telecommunication work which is a function of both our hardware——

The CHAIRMAN. I almost ought to charge you advertising rates for this.

Mr. WEINBERG. Well, I will go through this real briefly.

The CHAIRMAN. I am fascinated. I am just saying you are taking the best advantage of the opportunity.

Mr. WEINBERG. I would like to let you know what we are doing in the House.

The CHAIRMAN. That is what I want to know. That is what we are here for.

Mr. WEINBERG. We also have various other informational data bases that are available for our clients to do research on, things like periodical abstracts and things like that. An executive calendar scheduling system is used both in the House and in industry to keep track of meetings and meeting room schedules and things of that nature. What we have done is taken a lot of applications that took a lot of time and effort in an office environment, and are com-

puterizing them. We have a dictionary on line, things of that nature. We also have gateway links to other people's computers. So a user of our system can access data bases on other people's computers transparently. In that sense we act like an information funnel.

Those are the services that Dialcom is presently offering.

What I would like to do is talk a little bit about is the technology that is emerging today, and perhaps wrap up with some potential possibilities for tomorrow.

Some significant advances have been made in the computer area. Perhaps the most significant influence is the silicon microchip which is now allowing cost-effective equipment, very small and portable, to be available at prices that were unheard of many years ago. In the world of office automation, this is making equipment and computers available to applications that previously we all thought were too expensive to use computers for. This is really what has caused the revolution in personal computers, which are now being applied in the office automation environment, as well as classical office automation equipment.

The second factor in the current computer hardware revolution has been the Winchester disc technology. Winchester units are small, self contained, sealed disc modules, usually about the size of a shoe box, that enable a personal computer to hold vast amounts of information. This, combined with personal computers, puts a very, very powerful computer on a desk.

Also there has been very many developments in software techniques that have enabled the programs that people run on computers to be much more understandable and easy to use as well as very, very fast. Data bases are probably the most significant ones. Structured programing is another one. These are techniques being used to develop the software so people can use computers that have had no previous computer experience before.

Also many things have been happening in telecommunications. Local area networks is one of them. Developments of standards so that different vendors and machines can talk to each other. All these things are happening and being applied to improve communications between people these days, as well as computers, and that is really what office automation addresses itself to, to bring computer power to the office user, to make that person more productive.

Industry standards are very, very important. I have heard several people mention them, and you have asked some very good questions. Dialcom is very much behind the establishment of industry standards. It is our feeling that these are going to become more and more important throughout the years, especially as users demand that vendors adhere to these standards and as the Federal Government implements those standards as prerequisites for procurement of equipment. It is something we felt was very important and, as a general policy, Dialcom adheres to all standards that are established or are being established. We are currently in the process of working with several standard committees to help establish standards in certain areas, such as electronic mail.

The types of things that would be useful for the Senate in terms of general recommendations, these may be reconfirming some things that have been previously mentioned.

Obviously, I would recommend that you should want a system that is going to be upward expandable as the applications that you would like to use for the computer also expand. It is very important that you get equipment and services that conform to standards so that the equipment you do get can talk to each other. You do not want to get locked into being stuck with a particular vendor's equipment or an old technology, and standards also address themselves to technology improvement as well.

Another thing that is going to become more important is the local area network or the general protocol conversion facility, be it a piece of hardware, or a network, or a piece of software that will allow different vendors' equipment to talk to one another. It is probably not desirable that every vendor build equipment or services that look exactly the same and operate the same. Each person's or vendor's device usually has some nuance or philosophy behind it that is very good for certain conditions, and very bad for others. These types of differences can—what is important is they conform to communication standards so information can be passed from one system to another, even though the systems themselves may look different internally to the user and the way they store data.

In conclusion, I would just like to say that Dialcom has specialized in office automation throughout the life of our company, both before the House of Representatives application and office automation in general. We appreciate the opportunity to participate in your proceeding and at this time I would be happy to answer any questions that you may have.

The CHAIRMAN. Well, thank you very much.

One thing that you have anticipated is how new technology is affecting the service you are already offering in the House of Representatives. Although I was teasing you a little bit about describing how you are offering services, that was extremely interesting. That was one of the things I was particularly interested in.

What about the standards question? Is the industry doing enough in the standards area?

Mr. WEINBERG. I think the industry is doing a pretty good job at this point establishing standards or working toward that point.

The CHAIRMAN. What more should be done?

Mr. WEINBERG. Well, there is, I think, a big problem in adhering to the standards. For instance, there is a standard that has been developed for word processing codes. I do not know of any vendor to date that adheres to these standards, and there is really little incentive for vendors to do so until they receive pressure from the marketplace to do that. Everybody is still hoping that what they do will be the universally accepted standard. In telecommunications, we have come a long way toward adopting standards. If you read some of the trade magazines, in each issue you will see some vendor or another offering packages that are industry standard compatible. The implication will be felt in the next several years very heavily, and it can only benefit the end user.

The CHAIRMAN. Would you tell us just a little bit more about electronic mail?

Mr. WEINBERG. Surely. Electronic mail is a computerized means of communication between one user to another user, or one user to a whole group of users. The way it operates is you sit down at a terminal, compose a message—very simple and fast—and have the computer deliver that message to other people's mailboxes—which are really in the computer—and those messages wait there until they get onto their computer and say I want to read my mail. At that time, they receive your messages and they can respond to them. They can just read them, they can forward them to another person, they can file them, they can do all kinds of things to them. The filing of messages is very important because it goes into a data base whereby people can very quickly and easily retrieve information on a specific subject or any one of a number of different ways for later use. Its advantages are that it helps people in their productivity by reducing the interruptions received by telephone calls. That is one of its big features.

The CHAIRMAN. Is this a printout or is it reading from the screen?

Mr. WEINBERG. It can be either. It depends on the device you happen to be using.

The CHAIRMAN. Or both?

Mr. WEINBERG. Right. It also allows——

The CHAIRMAN. At whose option, the receiver or the sender?

Mr. WEINBERG. The receiver, the person receiving it has that option. In many organizations, user receive the message over their CRT terminal, and if they want something in hard copy, they mail it to another computer mailbox which is the word processing department. In this way each user does not have to have a printer, but has the capability of getting hard copy when they need to get it.

Electronic mail gives the ability to distribute information. It is as easy to send 100 messages as it is to send 1. You just type the message once, tell the computer to send it, and it puts it into each person's mailbox so that each person can pick it up. It is very good when you have time zone differences. It is also very good when people are playing telephone tag with one another because they are in and out all the time. It is a store and retrieval type system.

Dialcom uses it not only to offer it to people, but various other computer systems now use our electronic mail system. For instance, we have a calendar system and you and I both are users and I scheduled a meeting for you. The computer would automatically send you a piece of electronic mail indicating the date that I scheduled a meeting for you. So we are integrating these various products to make them very, very powerful. We have also integrated mail with UPI called Newstrack, which is essentially an automated clipping service. So whenever a story comes over the wires that you have a particular interest in, it automatically puts it into a piece of mail and sends it to you. You just read your mail and any story that came across the wire you wanted to see would be in your electronic mail.

So it can be used for a lot of things but most of the computer and office automation consultants are in consensus that it is probably

the most cost-effective and beneficial office automation system that can be installed, has the earlier payback and most beneficial results.

The CHAIRMAN. One final question.

Where does your principal competition come from, domestic or foreign?

Mr. WEINBERG. Well, it is really domestic. The concepts in office automation and much of the hardware, and certainly the software, really evolved in the United States. Most of our competition is by three or four or five companies in the United States. We are currently marketing internationally. But Dialcom is now ITT Dialcom. That is something that we feel is going to strengthen our position internationally. Our software is being offered by governments in Great Britain, Australia, Hong Kong, and Singapore, and recently the CNCP [Canadian National-Canadian Pacific] Railroad-Utility will be offering our software for use in Canada. We are marketing internationally to the PTT's, Postal Telephone Telecommunication Agencies. In various countries, our software is the offerings—official government offerings by that country.

What is evolving is a de facto Dialcom network for electronic mail. As a result of that, we have been very active in establishing standards. We are the only vendor capable of international electronic mail delivery today. You can, on Dialcom, send a piece of mail to somebody in any one of those countries without having to know anything other than their name, and indeed that is happening now in the House of Representatives. They are now sending mail internationally, as well as to agencies for case work, and to some of the committees in the House that are using it.

For instance, the Science and Technology Committee is communicating with Westinghouse Defense Division, and they have eliminated a lot of the paper transfer. So they have sped up the time it takes to get information transferred and they do not have a problem with lost paper, and everybody is very happy.

The CHAIRMAN. You say sped up the time. What would be a typical delivery time?

Mr. WEINBERG. Well, domestically the instant that you send a piece of mail to somebody, it is sitting in their mailbox waiting for them. Internationally, it is within 10 minutes.

The CHAIRMAN. All you have to do is get his attention?

Mr. WEINBERG. That is correct. Like a lot of other things, this is only as good as how often people use it and how.

The CHAIRMAN. That is the greatest weakness of the CIA. It is not the dedication of the people that work in Langley. It is the limitation of time on their consumers to read the product after they have painstakingly accumulated it.

Mr. WEINBERG. That is a very important issue that office automation is attempting to address, that is, that the amounts of information that are being presented to people these days is virtually indigestible. What we and other vendors are attempting to do is package the information such that the average user can understand it, and this may in some cases mean graphical illustrations. In some cases it may be in segregating the information to areas that are of predetermined interest. There are a lot of techniques that are used, but this is really what American industry is very

concerned about. It is improving the productivity of their managers and executives who are constantly bombarded with paper, facts, and figures and information. They need that information to make good decisions and keep ahead of the competition, and certainly other countries. That is a real challenge.

The CHAIRMAN. We are very grateful to you for coming.

Mr. WEINBERG. Thank you very much.

The CHAIRMAN. I think you are a very impressive pinchhitter and am glad that you are here.

Mr. WEINBERG. Thank you very much for the opportunity.

[The prepared statement of Mr. Robert F. Ryan, president, Dialcom, Inc., follows:]

PREPARED STATEMENT OF ROBERT F. RYAN, PRESIDENT, DIALCOM, INC.

Mr. Chairman and Distinguished Members of the Committee: One of the greatest challenges to the computer and office technology industry has been to provide systems that can be specifically and easily used in a non-technical environment. On Capital Hill, our industry must additionally address the specific and unique requirements of a Congressional office.

An important key to productivity in a Congressional office is how well a staff is able to manage communications—be it with constitutents, federal agency liaisons, committees, other senators or even the airline ticket office. As recent as seven or eight years ago, Represenatatives and Senators were attempting to deal with their legislative, communications, and information needs with only basic tools of office technology—electric and mag card typewriters, copiers, dictating and facsimile machines and, of course, the telephone. My company began providing office productivity services to Congress in 1974, after receiving a request from a Representative to study his office needs and design a system to automate the constituent correspondence. A basic function of any correspondence system should be the ability to match names and addresses and print letters. The initial system has been developed to accommodate a number of other functions unique to the Hill, such as tracking and reporting on casework, District projects, and public opinion. Based on the correspondence data entered into the system, the ability to track trends in public opinion are easily seen via statistical reporting features.

Advances in telecommunications and terminal hardware have provided further avenues for computer applications on the Hill in the area of internal communications and information exchange. Electronic mail is a Dialcom service that was introduced on Capital Hill in 1980. Since then, it has revolutionized the speed with which Members and staffers can communicate among themselves, regardless of geographical location or time zone differences. Over 300 Member offices have "electronic mailboxes" for sending and receiving messages and other information in seconds. Electronic mail is being used for messaging among Members and staff in both Washington and District offices, for requests to the airline ticket office, and for requests to the Document Room. Caseworkers have are also able to use electronic mail to communicate with the Congressional liaison offices of the Social Security Administration and the Veterans Administration.

Representatives are taking advantage of systems that fulfill a number of specialized requirements. At the same time, they are moving up the learning curve toward a greater knowledge of the useful application of automation for increasing office productivity. Although the process of educating the Congressional user community is an ongoing one, it has become clear that the "Office of the Future" in fact is here, is affordable, and is specifically oriented to House and Senate applications. In fact, it is your very type of business that has such dramatic needs for advanced technology in the areas of information, telecommunications, and support systems.

INDUSTRY TECHNOLOGY TODAY

The direction of the computer industry has changed dramatically in the past several years. Recent advances in hardware and software technologies have resulted in computers that are smaller, faster, more powerful, and less expensive than previously thought imaginable. No longer are computers kept behind the doors of large organizations with large data processing requirements. Many of today's computers are finding their way into non-data processing applications as wide ranging as auto-

mobiles, video games, industrial robots, word processors, and the personal/family computer.

Technological advances that have brought about this phenomenon can be divided into four categories:

(1) Computer hardware:

Undoubtedly the most significant influence in the current computer revolution is the silicon microchip. Computer circuits that previously required cabinets of vacuum tubes or circuit boards full of transistors are now available on microchips smaller than a dime. The cost savings realized during the manufacturing process of these integrated circuits has resulted in the application of computer "intelligence" to various products, often replacing less reliable mechanical systems.

Reduced computer size and cost has brought about the phenomenon of the office/personal/family computer. This device will not, as first supposed, replace the large mainframe computer used in classical data processing applications. It does lend itself, however, to applications (such as word processing) previously overlooked or considered unfeasible by data processing.

The second factor in the current computer hardware revolution has been the Winchester disk technology. Winchester units are small, self-contained sealed disk modules usually about the size of a shoe box. These sealed units are very reliable, and can be put into environments where temperature, humidity, and dust cannot be controlled as they can in a "computer room". Unlike diskettes, the disks are not removable, but the storage capacity of these units is now beginning to rival the multiplatter removal disk pack drives found on larger, mainframe computers.

The merging of these two technologies has resulted in the small business, or office computer, such as the Texas Instruments Business System 300 on which Dialcom is now offering its Congressional Correspondence System to the House.

(2) New software concepts:

When online terminals replaced decks of punched computer cards as the means of accessing information, new software designs were required to organize often huge amounts of information that needed to be instantly accessible. The answer was found in programming techniques and computer file structures collectively named "data bases".

At first data bases were used for large online applications on large mainframe computers. More recently, however, they have found general acceptance for a wide Range of applications. Dialcom has integrated this concept in applications as diverse as our United Press International service, our Congressional Correspondence System, our Calendar Scheduling system, as well as our Electronic Mail offering.

(3) Telecommunications:

Telecommunications is the field of computer-to-computer and people-to-computer communications. The need for organizations to collect and distribute information to geographically dispersed locations, and to offer centralized information banks (data bases) to offices around the country and the world has necessitated major advances in this field.

A major step towards accomplishing this was taken with the adoption of an international communications standard, called X.25, by the CCITT (International Consultative Committee on Telegraphs & Telephones), an international telecommunications standards organization. The importance of X.25 is that it allows different vendors' computers to talk to each other and exchange data.

X.25 also enabled the creation of public "packet switching" data networks that allow people or computers to access any other computer on the network. This standard also enables domestic networks in different countries to connect with each other, since they all "talk" the same language. For instance, users throughout the world can interactively access Dialcom's computers with a local telephone call.

(4) Industry Standards:

The importance of establishing industry standards has increased over the years as the number of vendors and types of equipment has proliferated. The X.25 standard I talked about under telecommunications is but one example.

You have probably heard of CPM in advertisements and articles about personal/office computers. CPM is an operating system standard developed for these microprocessor based machines that allows programs written for one computer to be easily transferred to another CPM based machine. CPM has also made it easier for people to use these machines because the commands used to operate them are the same from one computer to the next.

In general, standards make products and services easier to use. They enable consumers to more easily compare their features and capabilities thereby making more intelligent choices in what has become a very fast moving and often confusing marketplace. Equally important is that standards enable users to choose the best equip-

ment and services for their needs from a variety of different vendors, with the ability to integrate them in organization-wide systems. Adherence to standards also allows organizations to upgrade their equipment and services with minimal impact on their user communities.

Standards have become very important in the field of office automation for these very reasons. Word processors and facsimile machines are perfect examples. In the past, most organizations allowed each office to purchase its offfice equipment from whatever vendor these organizations chose. Now they are discovering that very few of these devices can communicate with each other. Several vendors, including Dialcom, have sought to alleviate this situation somewhat by acting as interpreters between non-compatible equipment, but the long term solution is the creation of and adherence to universal standards applicable to all these machines.

We at Dialcom strongly believe in the benefits standards bestow upon both vendors and users of computer products and services. We are working very closely with various standards organizations to establish and promote industry-wide standards. At this moment a CCITT standards committee in Paris is voting on Dialcom's intracomputer electronic mail delivery protocol for adoption as the international standard.

What do the technological advances in these four areas mean for today and the future? Let us limit overselves to the topic of interest to all of us here today: office automation.

What we are seeing today is a synthesis of these technologies being applied to various office systems, for the purposes of:

(a) Improving the productivity of office workers, to help control the cost of organizational functions perceived by business as "overhead".

(b) Improving the flow and quality of information available to executives and managers, to promote more informed and therefore better decisions. Thus to enable large organizations to more quickly respond to changing political, financial, international, and regulatory conditions, and for:

(c) Improving the productivity and effectiveness of high salaried executives and managers.

Today's automated office has applied computer technology to automate and improve specific office functions. Electronic mail systems are being used to improve the flow and speed of information throughout offices and organizations. Both electronic mail and micrographic systems are being used to reduce the amount of paper and therefore storage and filing costs, as well as eliminating the lost message, memo, and letter.

Various text and word processing devices and systems are being used to increase the quality, and control costs, of producing letters, reports, and other documents. Integrated with electronic mail, documents are being prepared, assembled, and distributed at a fraction of the cost and speed of using conventional means.

Computerized filing systems facilitate the storage of documents and information, and enable quick retrieval of either computerized, paper or microfilmed material.

Computer calendar scheduling systems are saving secretaries hours of calling other secretaries when attempting to schedule a meeting among busy executives and managers. These systems are also being used for scheduling community facilities such as meeting rooms, projectors, motor pool vehicles, etc.

Project tracking and tickler systems help managers keep track of projects and due dates, to delegate work to subordinates and be reminded to follow up on their progress, and in general to prioritize their projects and better organize their time.

Data bases both inside and outside organizations are giving managers and executives more timely, more accurate, and more meaningful information. Public subscription data bases are available covering a wide range of information including news, periodical abstracts, legal information, financial information, etc.

SPECIFIC APPLICATIONS FOR THE U.S. SENATE

Relative to your investigations into computer technology as it could apply to Senate Office over the next 2-5 years, you may wish to consider the following applications. This sampling of Dialcom products represents services already in use in both government and business environments.

(1) Communications Systems.

Electronic Mail System.—Users can receive and send messages, speeches, reports or forms using a personal "electronic mailbox". With almost any type of computer terminal (ranging from elaborate communicating word processcrs to a hand-held terminal), users may exchange messages, documents or any other kind of information at any time from virtually any location where an ordinary telephone is availa-

ble. Messages can be sent with options for courtesy copies, blind copies, reply required, acknowledgement requested, confidential, and express (priority) delivery to one or more recipients. Mail can be precomposed and held for further editing, embargoed for later delivery, and/or electronically filed for subsequent retrieval.

Uses.—Over 300 Member offices and organizations are now using Electronic Mail in the House. Applications include Whip Notice distribution. Dear Collleagues, Staff memos, approvals of letters, speeches, press releases, ordering Documents, Airline reservations and ticketing, casework inquiries for Social Security and the VA, and general messaging and information distribution.

Word Processor Electronic Mail.—With a varity of terminals available to the Congress, few of them can "talk" to each other. Dialcom's special option of the Electronic Mail System can transmit "clear" text from storage devices between and among various brands of word processors. A most impressive feature of "WPMAIL" is in its cost saving ability to "batch" communications in an offline mode (not connected to our computer) before transmittal.

Uses.—A speech contained on the District Office's XEROX word processor can be transferred to the Washington Office's WANG word processor.

Telex Messaging Interface.—Adding over a million delivery locations around the world, the Telex Interface can be used to send or receive messages to or from any Telex terminal.

Uses.—A Senator needs to contact the American Embassy in Paris, France. An electronic message can be delivered to the Embassy's TELEX terminal from the Senator's word processor or other terminal. Additionally, the Embassy can send a TELEX back to the Senator, which can be delivered to the Senator's electronic mailbox—within minutes.

E-Com System.—The US Postal Service's "Electronic Computer Originated Mail" can be used for constituent communiques needing a 2-day delivery. Dialcom can direct letters to specially equipped Post Offices, where the letters are printed in a form similar to Mailgrams and sent first class.

Uses.—A Senator wished to send an E-COM letter to a list of 800 members of the Chamber of Commerce—for delivery within two days. Rather than printing the letters in the office, the letter and list of names is tansmitted to specially equipped Post Offices, where the letters are printed, stuffed and delivered by the US Postal Service.

Teleconferencing System—An electronic teleconferencing system permits ongoing discussion among a group of individuals on one or more topic(s). They may be open to all or kept to a restricted group, where only invited users may join, read and add conference notes.

Uses.—Committee counsels can engage in an electronic conference for group input on amendments to legislation or committee reports. All comments or suggested text for such documentation is recorded for historic reference and can be transferred into final copy.

(2) News and Information Systems.

World-Wire.—UPI and many foreign wire services send state, regional, national and international news to newspapers throughout the world. Dialcom continuously captures these news streams, automatically "keywording" each story. Our new "profile clipping service" can automatically search the wires to capture stories designated as key to a member's interests. The stories are automatically "mailed" to the individual's electronic mailbox.

Uses.—Senator Jones and his Press Secretary automatically receive in their "electronic mailboxes" all wire service stories on the MX missile as well as all stories containing his name. They are received at the same time his local newspapers are seeing them. The Press Secretary notices an error in a quote from the Senator and a correction is immediately submitted, in time for the edition in which the story was scheduled to appear.

ABI/Inform by Data Courier.—An easy to use verison of Data Courier's ABI/INFORM, the most popular business and management data base used by today's major businesses. Over 150,000 succinct, 200-word abstracts from over 500 worldwide business journals help decision makers in the areas of accounting and auditing, economics, finance and financial management since, and human relations. Journals include the Harvard Business Review, Barron's, Yale Law Journal, Canadian Business, Management Today (United Kingdom), Informatique & Gestion (France) and Manager Magazin (Germany).

Uses.—In preparation for testimony to be given on the effect of government regulation on business, the Senator's speechwriter pulls current information comparing this issue in the US, Canada, and Japan.

12-900 O - 83 - 6

Official Airline Guide by Dun & Bradstreet.—Up to date flight information listing flight times, fares (North American flights), aircraft type, meal service, rental care and hotel details—all are available from the computer terminal. Direct and connecting worldwide flights of more than 625 airlines are listed in 105 city-to-city pairs. This electronic edition of the OAG contains information comparable to that now in use by the Combined Airline Ticket Office, which you currently use for airline reservations and ticketing.

Uses.—The Senator needs immediate information on flights to San Francisco. His Secretary checks the OAG data and is able to instantly offer all flight information necessary. The Secretary then electronically transmits the reservation and ticketing request to CATO, which in turn electronically confirms the transaction.

Gateway Link.—You can establish a connection to any computer system worldwide accessible through the public data networks. All account validation and access procedures must, of course, be preestablished with the vendor of that system. In addition to a "user-friendly" link to systems currently available to the Senate, approved links could be established for other useful computer data banks, such as Westlaw, Dow Jones News Service, and others.

Uses.—The Senator and his Economics Specialists can check the Dow Jones News Service for Wall Street Journal articles of committee interest.

(3) Executive Support Systems.

Executive Calendar System.—With the Calendar System, you can scan the schedules of several people at once; display open time slots; check the availability of the committee room or the Senator; place a meeting in all schedules—with a single entry. Scheduled items can be tagged as accepted, pending, declined, cancelled, or just a reminder. Any change in status, date, time, or appointment details can be made easily. The system automatically checks for conflicts arising with previously scheduled items. Calendars can be printed or displayed in monthly (block style), weekly or daily formats. Whenever an appointment is scheduled, an electronic message can be automatically sent to the people involved. Calendar privacy is maintained by individually controlled access lists. Additionally, a private calendar is available which may be seen only by issuing another, private password.

Uses.—Committee staff can use the Calendar System to schedule committee or subcommittee rooms, slide projectors. Senator's schedules can be electronically kept for access by approved staff. With everything electronically recorded, the schedule may even be used as a journal or history of activities.

Electronic Phone Messages.—In less time than it takes to fill out a "While You Were Out" slip, the Receptionist can enter electronic phone messages. The system eliminates lost phone memos and the struggle to decipher handwriting. Each message can also be filed, permitting the system to function as a phone log and "rolodex" of phone numbers and names.

Uses.—Staffers can pick up their missed phone calls by simply signing onto their electronic mailbox. Besides reducing the traffic pattern around the receptionist's desk, the message system can keep an automatic phone "log" of all incoming calls—a procedure now often done manually.

Text Editor and Dictionary.—Integrated into every major Dialcom system is a powerful Text Editor that can function as an independent word and text processing system or as an auxiliary to your word processing equipment. A report, speech, transcript or any other document can be custom formatted for automatic page breaking and numbering, titles and footers, as well as in index and table of contents. A single command can also activate a process to check your text against a 56,000 word DICTIONARY for detection and correction of spelling errors. Additionally, personal dictionaries can be created for acronyms or words unique to Capital Hill and the government.

Uses.—The Editor has universal applications in the creation and editing of text. The Dictionary is an invaluable feature that provides computerized "proofing" of newsletters, press releases, correspondence, or reports going out of a Senate office.

Congressional Correspondence System.—To facilitate the traditional letter communications and aid the quality production of letters, envelopes, franks, labels, postcard, lists and directories, the Dialcom CCS package is the most widely used computerized correspondence system in the House of Representatives. Over 200 House offices utilized this system. A central directory organizes fragmented mailing lists into one data base. The automatic name search feature eliminates duplicate entries. Mailings can be targeted for special issues as well as constituent occupations and interests. As described previously, this package offers systems for Case Tracking, Appointment Scheduling, District Project Tracking, Correspondence Analysis Reporting, and Batch Letter production.

This concludes the formal part of my statement. As Dialcom is recognized as a worldwide leader in the field of office automation, we do appreciate this opportunity to participate in your proceedings. We thank the committee for allowing us to not only discuss our products, but the rapidly emerging technologies and how they will greatly impact a changing Senate "Office of the Future". At this time I will be happy to answer any questions you may have.

The CHAIRMAN. We have an expression of interest on the part of a number of the Members of the Senate and executives of the computer industry who wish to submit statements. It was not possible to hear all of them today but, in order to give both the industry and Members of the Senate an opportunity to express themselves for this record, we will hold the record open for 10 days for the submission of additional statements.

The committee will stand adjourned subject to the call of the Chair.

[Whereupon, at 3:40 p.m., the committee adjourned, subject to the call of the Chair.]

[The following statements, letters, and other materials were subsequently submitted for the record:]

PREPARED STATEMENT OF HON. WILLIAM L. ARMSTRONG, A U.S. SENATOR FROM THE STATE OF COLORADO

Mr. Chairman, I appreciate the opportunity to submit testimony in support of alternative computer systems for correspondence, office management, and other functions in Senator's offices.

As you and the other members of your committee know, I have been interested in this subject for some time and believe the Senate can benefit substantially by allowing computer companies to compete in offering services to Senate offices. As a first step in this direction, I believe the Rules Committee should act to set up a number of demonstration projects using a variety of computer companies and services. For the last three years I have requested approval for such a demonstration project in my office. I renew that request today.

Specifically, I urge your Committee to select several of the various commercially available systems that provide in-office computer capability, text editing functions, and flexibility to add terminals for correspondence and word processing throughout the office. These systems, many of which the committee is reviewing today, will:

Make more efficient use of computer time. Routine tasks can be performed at so-called "smart" terminals without burdening the main computers. With the system now used by the Senate, every terminal is connected directly to the computer . . . overloading the system, leading to long access delays, and eventual increases in contract cost.

Provide greater flexibility to suit individual office requirements, work schedules, and staffing patterns. The individual system can be tailored to a single office, something not possible with a Senate-wide system.

Provide text editing, word processing, and computer capability in the same system. Most Senate offices now use a variety of equipment to handle the office workload. The Senate computer system is used to handle large volumes of mail. But, because it is cumbersome, offices also have a variety of automatic typewriters, mag card machines, etc. to handle other letters, speeches, floor statements, etc. Most of the systems the Committee is reviewing are capable of handling all those chores . . . with a resulting savings in equipment costs.

Provide training and user representatives. Many of the commercial systems include training as part of their overall contract, eliminating the need for a large Senate employed staff to train offices.

Provide other office management functions. Most of these systems have scheduling, indexing, and financial account capabilities all of which can be utilized in the management of a Senator's office.

For these reasons, I urge that your Committee establish demonstration projects in several offices, using a number of competing systems. As a practical matter, such a demonstration program could be implemented almost immediately. With many offices scheduling moves, this would be an ideal time to put such a program in place so that equipment, terminals and the like can be factored into office layout.

I am eager to assist in this effort and hope you will call on me if you have further questions.

U.S. SENATE,
Washington, D.C., December 3, 1982.

Hon. CHARLES MATHIAS,
Chairman, Senate Rules Committee,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: Thank you for your letter of November 15. I would like to take this opportunity to comment on the continued development of the Correspondence Management System as well as two CMS-related matters which your Committee may consider on December 8.

My office has been testing the Text Editing system of the CMS for the past year. The Editing system has been quite a success—it has drastically reduced the amount of time and effort required to respond to the growing volume of mail from my constituents. For example, it is possible for my staff to review and correct three times more letter drafts using the Editing system than using paper drafts.

In addition to condensing the amount of staff time needed to compose and edit responses to constituents, the Editor system has been useful to previously untrained staff members who want to create and store text on CMS. Professional legislative assistants have used the Editing system extensively for their word-processing needs, such as preparing memoranda.

The success of the Editing system has intensified the need for additional Editor-accessible terminals in my office. While many attempts have been made to provide computer time to those who need it, some staffers have, by necessity, needed to use the Editing system to the exclusion of others. I believe that at least four more Editor-accessible terminals are needed in my Washington office to alleviate this problem.

In my Dallas and Austin district offices, the CMS casework system has enabled staff members to respond to constituents' needs very effectively. I am extremely pleased with the system, and I hope that the present limit of two CMS locations per state could be increased to include my third office in Houston. In addition, due to the rising amounts of case-related correspondence, the present allocation of standard CMS terminals in my field offices is insufficient, and any increase in their number would aid my staff tremendously.

I strongly feel that it is my responsibility to run an efficient office, staffed with competent and dedicated people. Their job can only be done properly, however, if they have the necessary tools at their disposal. The Editing system has performed remarkably well this year, and it should be developed to its fullest capabilities as soon as possible. The work already done by you, your Committee, the Sergeant at Arms, and the Senate Computer Center is indeed appreciated. I trust that you will continue building the CMS by offering the Editing system as a full component, increasing the number of terminals for appropriate Senate offices, and implementing the 1,200 BAUD transmission speed.

Thank you for your prompt attention to this matter.

Sincerely,

LLOYD BENTSEN.

U.S. SENATE,
Washington, D.C., December 10, 1982.

Hon. CHARLES MCC. MATHIAS,
Chairman, Committee on Rules and Administration, Russell Senate Office Building,
Washington, D.C.

DEAR MAC: Thank you for talking with me yesterday concerning the Hart Building. I really would appreciate your help in resolving the problem we discussed.

I'm sorry I wasn't able to testify at your December 8 hearing on Senate computer services. Markups in two of my committees prevented my appearance. Therefore, I wanted to bring to your attention some of my suggestions and concerns.

I was very excited to learn from you that the Rules Committee is prepared to establish pilot offices for new services. On several occasions you told me that you wanted my office to serve as a pilot office for computer operations. This is an exciting prospect and it is one that I believe is sorely needed. I hope you will let me know if there is any information you might need and any help I can give you. I've

asked Dan Beard, my Administrative Assistant, to follow-up with John Childers to help in any possible way.

My office has been concerned about the Senate computer system for several years. In my view, the most important issue concerns information storage and retrieval. Periodically, I am asked by constituents to keep them informed of the Congressional progress on certain issues. But, retrieval through the NAR (Name, address retrieval from the Senate mail list) program requires extensive clerical efforts to correct salutations lost when the names were shifted off-line. Why is that necessary? If it was important enough to enter the first time, this information should be accessible at all times.

In order to preserve the salutations, my staff keeps many names and addresses on-line. Name and address entries are duplicated since each name must be entered and kept separately for each issue mailing list. This means address correction efforts are duplicated.

I am disturbed by several other deficiencies of the computer services now available. The current system is inadequate, fragmented, inefficient and outdated.

I know that the Rules Committee is reviewing the draft of a request for proposal (RFP) for a replacement system. But, the RFP process takes time. I would encourage you to direct that some changes be made immediately. Here are some suggestions.

A computer service should provide centralized, comprehensive and accessible data storage. I represent a small population, rural state and I feel strongly that the existing system penalizes offices like mine.

During the normal business day, I like to call some of my constituents to learn their views, opinions and comments on legislation on which we will vote. My constituents expect, and rightfully so, personalized service, such as remembering names, nicknames, spouses' names, childrens' names, addresses and phone numbers. The Senate computer system cannot store this information. So, my staff has to maintain a reference file to provide me with reminders I want of this material.

My press secretary has compiled a file with the names of periodicals in my home state. He has a reference card for circulation, deadlines, addresses, phone numbers and names of editors and reporters. He has similar information for the radio and television stations. This is all stored in a card file.

A good computer system could and should replace my office card files!

This Correspondence Management System (CMS) is too fragmented. Address corrections sometimes need to be made three or four times. Names and addresses can be stored on-line in CMS, off-line on the Senate computer center's First and Second Master lists and in the Mini (press) file. And, none of these can store telephone numbers!

I applaud the Senate's acquisition of its optical character reader (OCR), but why do the address corrections need to be sent to the Computer Center? Why can't the Senate arrange to lend offices hand-held wands to process some of the returns? The computer center points with pride to the large number of corrections they successfully process, but the majority of those they can't process were done in advance by my staff.

Many of these address corrections could be avoided if the Rules Committee moves to permit use of Postal Patron mailings. I try to hold town meetings and office hours whenever I am home. These announcements could be sent more economically if they were mailed with the simplified address eliminating the expensive address corrections.

Technology exists to use OCR's for data entry. It is my understanding that the Senate OCR is used only for deletions from the Senate mail list. Does the Senate have any plans to use its OCR for data entry?

When will the Senate computer system provide word processing programs? The CMS text editor is too cumbersome. Retyping drafts of a speech, press release or newsletter can often be done faster on a typewriter than by editing it on CMS.

Montana is the fourth largest state which requires me to maintain six state offices. The current Senate allocations permit me to have computer terminals in only two of my offices. To serve my constituency, I would strongly urge allocation of more terminals in each Senate office.

More and more often, each of us encounters periodicals which discuss the availability of revolutionary office automation systems. Home computers, mini computers, and micro processors are no longer rumors, they are in use in offices throughout America. The Senate should actively seek out and use this equipment.

Again, Mac, thanks for all your help.

With best personal regards, I am

MAX BAUCUS.

U.S. SENATE,
December 8, 1982.

Hon. CHARLES McC. MATHIAS, Jr.,
Chairman, Committee on Rules and Administration,
Washington, D.C.

DEAR CHAIRMAN MATHIAS: Thank you for your recent letter inviting me to submit testimony at a hearing of the Committee on Rules and Administration on December 8, 1982. I want to congratulate you for holding this hearing. Tremendous advances have been made in the Senate in the last few years concerning computer and communication services. These advances have enabled me to respond to my constituents in a more timely and efficient manner. As you know, the bulk of my CMS operation is in my state office in Florida and I look forward to further improvements in the system such as the increase in printing capability of the AJ Printer to 1200 words per minute. I have previously expressed my interest in having this capability.

My greatest area of concern with the present system is my inability to make corrections to archived groups. Some of my groups exceed 30,000 names and addresses, which makes updating just about impossible as long as they have to be brought on line. Having this correction capability would be extremely helpful in my daily operations.

I look forward to future enhancements in the system and appreciate having the opportunity to provide my testimony.

Sincerely,

LAWTON CHILES.

U.S. SENATE,
Washington, D.C., December 6, 1982.

Hon. CHARLES McC. MATHIAS, Jr.,
Chairman, Committee on Rules and Administration,
U.S. Senate, Washington, D.C.

DEAR MAC: As the Rules Committee considers equipment needs of Senators, I would like to itemize for you the functions for which my office needs appropriate equipment.

(1) We need small on-site computers, one for my California field offices where all my casework is done. The computer should be located in San Francisco with one terminal and a second terminal located in my Los Angeles office. We need a second computer in my Washington Office which would accommodate a combination of personnel files, legislative indexing, and scheduling. This second computer should be able to communicate with the one in San Francisco.

(2) I would like to begin to introduce word processors for my legislative staff. Our need is for more up-to-date composing and editing equipment with a very modest letter production capacity. We would want on-site equipment with total in-house control.

(3) If newer equipment is available which will respond to batches of mail—up to 10,000 responses a week—at printing speed of at least 92 characters per second, with concurrent automatic envelope addressing, using regular letterhead stationery (both sides of the paper) with on-site control, we would like to learn about it.

(4) There is also widespread need in the Senate for a signing machine which can produce a facsimile signature faster than the present autopen equipment (the speed is the same for automatic signature or hand-operated signature at the present time).

Sincerely,

ALAN CRANSTON.

PREPARED STATEMENT OF HON. ALFONSE D'AMATO, A U.S. SENATOR FROM THE STATE OF NEW YORK

Mr. Chairman, I welcome the opportunity to present to you and members of the Rules Committee this statement regarding my request for a word processing unit.

About one year ago my staff began discussions with the Sergeant at Arms office regarding the possibility of installing an IBM Displaywriter or its equivalent in my Washington office. This request was forwarded to the Rules Committee with the recommendation that "a suitable system should be brought into the Senator's office for an evaluation with communication between the Senator's office staff and the appropriate staff in the Service Department."

As you can well imagine, my office receives among the highest volumes of mail each month. This year our average monthly mail volume has been over 35,000 pieces, of which fully 10 percent require individual response. The timely, efficient answering of this constituent correspondence is of the highest priority to me and my staff.

Unfortunately, the current technology available to Senate offices does not allow for maximum efficiency in answering such mail. With the appropriate Displaywriter system, it is estimated that total letter production time can be reduced by up to one third, thereby reducing personnel requirements and freeing up precious office space.

By letter of November 20, 1981 to Senate Sergeant at Arms Howard Liebengood, I requested that a Word Processing Demonstration Project be established in my office. Since that time I understand that several other offices have made similar requests for advanced word processing system.

I commend the Committee for its consideration of these requests today. Fully appreciating the budget constraints under which the Committee must operate, I urge you to take advantage of this opportunity to test various word processing systems in the different settings of several Senate offices on a trial basis.

Both my staff and I stand ready to assist in the evaluation of these systems, whereupon the Committee will be able to better judge their efficacy in a work setting. Thank you for taking up this important matter.

PREPARED STATEMENT OF HON. WALTER D. HUDDLESTON, A U.S. SENATOR FROM THE STATE OF KENTUCKY

Mr. Chairman: Speaking for myself, but in fact I think this applies to most of my colleagues, I cannot come before this committee to talk in any technical detail about office systems automation. However, I can talk about serving my constituents' needs to the best of my ability, within the constraints imposed by the budget for my office.

Constituent mail consumes by far the greatest share of time by my staff. The Correspondence Management System installed some years ago has been of tremendous value in responding to constituents rapidly and effectively. But at the same time, the need for even more personalized responses has risen as the over all volume of mail has increased.

And as this need has risen, so has the amount of staff time devoted to this task. While a huge fraction of the total correspondence is reasonably adequately managed by CMS, the largest fraction of staff time is consumed in handling individualized inquiries—the so-called "ad hoc" letters.

I, for one, have welcomed this increase in constituent inquiries, statements of opinion and requests for assistance. I believe the give and take of correspondence has increased the awareness of our citizens of the role of the Congress, and has served to educate both ourselves and our constituents. For the foreseeable future, I predict that this trend will increase.

While this is a great benefit, it has also placed a great burden on our office staffs, both professional and clerical. As the flow of mail and the level of sophistication increases, so increases the time that must be spent servicing them, through the often lengthy process of research and writing and rewriting, and typing and retyping. This, in turn, has reduced the time available for the professional staff to perform their other functions, including the vital role of research and analysis of proposed and pending legislation, and drafting of speeches, floor statements, committee testimony, position papers and press releases.

What is particularly distressing is that the technology exists to ease this strain on staff time and increase our efficiency at the same time. And the very fact that proven appropriate technology exists raises some serious questions about all the discussions that have been held concerning the instituting of one or more pilot projects in office automation.

My office has been involved in two pilot projects within the last year, both based on technology currently in use by the Senate, and neither serving more than barely satisfactorily.

My questions, Mr. Chairman, are:

Does the Senate need to go through a lengthy pilot process to determine needs and appropriate technology to meet those needs? Or,

Should the Senate at this time be looking immediately at evaluating current needs and then proceeding to recommend a specific course of action to the Senate?

If my information is accurate, it appears that the office automation needs of individual Senators' offices are relatively simple—sophisticated word-text processing,

management of records, scheduling, and to a much lesser degree, office functions such as personnel and bookkeeping.

I am informed that numerous firms offer equipment that will fulfill those needs.

It seems to me that if the specific needs can be determined and adequate projections can be made for growth, then the task of selecting a system can be fairly easily made on the basis of the ability of a given system to perform the necessary tasks, and then on the basis of cost and maintenance.

I would not, of course, recommend making a decision that has not been well thought through and that has not been given proper consideration for its cost to the taxpayer.

But I believe when these factors are weighed, it will be determined that utilizing modern technology to make our Senate offices more efficient in serving our constituents will weigh most heavily in the balance.

Mr. Chairman, I would like to make one final point. We must recognize that no decision will be either perfect or without cost. What it amounts to, in the final analysis, is whether we pay considerably more to upgrade current systems, whether similar funds are invested in state-of-the-art technology, or whether we permit our offices to become less efficient, perhaps even less responsive. The latter seems to me to be the most expensive of all.

I would urge you to consider those things in your deliberations that will resolve the issue as expeditiously as possible, as well as economically as possible.

I thank the chairman and the members for permitting these remarks for the record.

Prepared Statement of Hon. Gordon J. Humphrey, a U.S. Senator From the State of New Hampshire

Mr. Chairman, I appreciate the opportunity to appear before this Committee to discuss the future direction of Senate computer services. I would also like to thank representatives from the various companies assembled here today who have taken time to come and make their presentations. I applaud the willingness of private industry to bring us their knowledge and experience. We all realize that computer technology is progressing quickly, and it is vital that the Senate keep us with these advancements.

At the present time, I believe the Senate is well served by Computer Center functions as they relate to the larger, bulk type mailings. I have always found that there is sufficient flexibility within Computer Center operations to carry out different types of these projects, whether they be statewide newsletters, or more selective types of mailings. Among other CMS programs, my office has found the Correspondence Tracking System particularly effective in controlling and managing the flow of constituent mail. Other CMS enhancements too numerous to mention here have also saved many taxpayer dollars through improved office productivity.

However, in looking toward the future, there are areas where Computer Center operations need improvement. In no area is this more apparent than word processing. Clearly, current CMS functions for word processing are not well suited for use by all Senate offices. Present word processing systems are at best cumbersome, and have fallen below the level of advancement available in office automation systems found on the market today. Many of the company executives present today may be familiar with Mr. Wayne Green of Peterborough, New Hampshire. Mr. Green is the publisher of 73 Magazine, Desktop Computing, InCider, and other similarly well known computer publications. He has maintained a deep interest in micro computers for some time now. I have consulted with Mr. Green at length on the matter of office automation and I am convinced that here in the Senate, we can do better, particularly in the area of word processing. That individual letters must still be done on typewriters is a sign that Senate offices are far behind the times in efficiency. The Committee should closely examine micro computers and what they have to offer in this regard. Certainly, micros would be more adaptable to individual offices as opposed to the present situation where one system serves all. In addition to this, the Committee should focus attention on expanding word processing capability into the hands of legislative and press staff. This would result in greater productivity, better organization, and much greater efficiency.

In summary, I am pleased to see the Committee consider alternatives as well as the improvement of services. Automation and word processing are the present and the future, and we should take full advantage of the available technology. However, we should not wait much longer to accommodate further studies and hearings. It is critical that we not allow services to get too far behind the level of technology that

is now accessible. As a further alternative, perhaps the Committee should consider changing Senate rules to allow those Senators who so choose to go out of house to a private vendor for their computer services. This would most certainly allow Senators greater flexibility than is now available. Either way, the time is now to proceed. Technology has left us behind.

I thank the Committee for this opportunity to present my views on this important subject.

PREPARED STATEMENT OF HON. MACK MATTINGLY, A U.S. SENATOR FROM THE STATE OF GEORGIA

Mr. Chairman: I appreciate the opportunity presented by you and the members of the Rules Committee to comment on the current state of office automation in the Senate.

We've come a long way since the days when each member made do with a single "secretary." Today, not only has the sheer volume of mail increased, but the number and complexity of the issues which a Senator is expected to address has increased as well. Fortunately, the Senate has placed at the disposal of its members a vast array of information age technology, handling everything from the status of legislation to constituent correspondence.

But high technology means rapid change. No matter how sophisticated the systems at our disposal, we must keep pace with the advances being made or lose the productivity advantage this equipment gives us. That is the challenge facing the members of the Rules Committee and I'm very pleased to see the members and staff devoting their considerable talents to this vital issue.

Currently, the Senate Computer Center has a contract with an outside vendor for a large, main-frame, time-sharing system for its Correspondence Management System (CMS). While this system was a considerable improvement over the tape-driven word processors such as the MTST machines it replaced, it still has a number of disadvantages compared to what is available on the market today.

Perhaps foremost of these disadvantages is the fact that as more and more CMS operators access the system, the response to commands entered by the operators becomes slower and slower. I am advised by my staff that this "time lag" frequently becomes quite noticeable and on occasion, it takes several minutes simply to "sign on."

A second problem lies in the 300 baud data communication rate between the terminals and the host computer. This slow speed is particularly cumbersome during the reviewing and editing of large text files such as speeches and floor statements. Incidentally, I would like to add that my office found the 1200 baud rate for CMS which was tested by the Senate Computer Center last summer to be extremely helpful and was disappointed when the experiment was terminated.

Finally, because the host computer for the present system is located in Pittsburgh, CMS uses extremely sophisticated telecommunications equipment and highly complex software. Consequently, the opportunity for something to go wrong is greatly increased and the overall system reliability is less than that of a simpler and less complex system.

One area of office automation technology I believe should be evaluated is the stand-alone, self-contained system. In contrast to large, time-sharing systems, the stand-alone systems offer a much greater degree of flexibility at the individual office level. A Senator would have the opportunity to automate tasks he felt needed automating regardless of the practice in other Senate offices. Moreover, even those tasks shared in common by all Senate offices could be automated in a fashion to suit the special requirements of each individual Senator. The problem of time lag and slow data communication that presently confronts CMS would be solved and a stand-alone system, being simpler and less complex, could well be more reliable than CMS.

In my judgement, when it comes to the acquisition of new office technology, the future is now. We are all aware of the dramatic decrease in cost for a mini and micro computers which has made the ownership of a computer possible for less than the cost of what many people pay for a stereo or a color television. The speed, memory capability and reliability of these small machines has increased geometrically. Moreover, the cost, capability and reliability of the peripheral equipment such as hard disks has shown equally dramatic improvement.

It seems to me it would be relatively easy to set up a pilot project where several of these self-contained systems can be evaluated. I understand several manufacturers have indicated a willingness to participate, and a variety of office automation

systems will be available. I know quite a few of our colleagues on both sides of the aisle who are ready to proceed today.

As Chairman of the Legislative Branch Subcommittee, I am intimately acquainted with the ever increasing workload on each Senator's office and the considerable resources required to meet that workload. I think we owe it to the taxpayers to run our offices in the most productive and businesslike manner possible. The increasing use of office automation, particularly smaller stand-alone systems, is one step toward that goal. I urge the Committee to implement such a test program as soon as possible.

Thank you very much Mr. Chairman.

U.S. SENATE,
Washington, D.C., November 29, 1982.

Hon. CHARLES McC. MATHIAS, Jr.,
Chairman, U.S. Senate, Committee on Rules and Administration,
Washington, D.C.

DEAR MR. CHAIRMAN: In response to your letter of November 11, 1982, I wish to have this letter expressing my views on computer and communications services made part of the record of the hearing on December 8, 1982.

Any consideration of new services should include a correspondence management tracking system that is part of or compatible with a full screen editor in a word processor system. An up to date word processor system is necessary for speeches, press statements, floor statements and other long documents which need to be revised or updated. Any new system must maintain access to the existing data bases and be able to access more as the need arises.

State offices must be able to access all capabilities that exist in the Senate computer services.

Duplication of equipment should be eliminated by combining more capabilities into one system.

While the CMS system is moving to meet some needs regarding large volumes of mail, it does not diminish the need for adequate word processing equipment suitable for all other office functions aside from correspondence.

Sincerely,

JAMES A. MCCLURE,
U.S. Senator.

U.S. SENATE,
Washington, D.C., December 8, 1982.

Hon. CHARLES McC. MATHIAS, Jr.,
Chairman, Committee on Rules and Administration, U.S. Senate,
Washington, D.C.

DEAR SENATOR: In response to your request for assistance in formulating plans for computer and communications services to the Senate over the next several years, I am taking this opportunity to express my opinion.

The current Correspondence Management System (CMS), for the most part, is highly functional in the production of constituent correspondence. Areas of potential improvement are: baud rate of transmission; availability of access ports; automated save of current file in the event of downtime; on-line indexing to be used for corrections to the index and/or being able to access index file by constituent name after take down day; and on-line mailing list capabilities for corrections or simply the ability to find mailing list records, without looking up on paper printouts.

When considering the replacement of CMS with an alternative system our primary concern should be the lack of flexibility in addressing a broad range of applications which exist in a Senate office environment.

I believe we should work towards continued enhancements of the Correspondence Management System.

With best regards, I am

Sincerely,

GEORGE J. MITCHELL,
U.S. Senator.

U.S. SENATE,
Washington, D.C., December 8, 1982.

Hon. CHARLES MATHIAS, Jr.,
U.S. Senate, Russell Senate Office Building,
Washington, D.C.

DEAR MAC: I am sorry that I am not able to attend today's hearing on the information processing needs of the Senate. I would like to submit the attached statement as my testimony.

I am looking forward to the outcome of this hearing. I anticipate and am hopeful that my personal office and the Committee on Commerce, Science, and Transportation will be included as participants in the pilot group.

Thank you for the opportunity to express my views on this subject.

Cordially,

BOB PACKWOOD.

Attachment.

PREPARED STATEMENT OF HON. BOB PACKWOOD, A U.S. SENATOR FROM THE STATE OF OREGON

SALUTATION

Mr. Chairman, I am pleased to appear before you today. I appreciate the opportunity to testify on the information processing needs of both my personal office and the Committee on Commerce, Science, and Transportation.

TESTIMONY

My personal office and the Committee on Commerce, Science, and Trensportation are active users of Senate computer resources. During the past two years we have aggressively pursued a program to integrate automated systems into our day to day operations. We currently have thirteen computer terminals in use throughout the Committee and two being used as a pilot test in my personal office. Our use of automated systems has grown steadily during the past two years to include text-processing, correspondence and mail management, office expense and personnel accounting, federal budget preparation and analysis, review of Senate Rules and Precedents, analysis of current and past legislation, plus the use of information bases available from the Library of Congress.

During these past two years we have become increasingly dependent on automated systems. This dependence on a centralized computer is painfully portrayed whenever response times are slow or the system is not working.

We have also found that some of these systems, in their current form are awkward, or inappropriate for the task to which they have been applied.

To support the work of my personal office and the Committee, I recommend that the following automated services be made available:

1. An easy to learn and use world processing system for everyday use and to prepare and edit complex documents such as manuals, reports, tables and speeches. I hope that the system which is ultimately provided will complement the current letter production system, Correspondence Management System (CMS).

2. A system to assist with the internal management of administration functions, including personnel-payroll and office expense accounting.

3. A practical system to assist my Appointment Secretary manage my schedule.

In addition, the following services will assist the Committee with management and analysis of authorizations and appropriations within the Committee's jurisdiction.

1. A system to help us better manage and track the authorization and appropriation responsibilities of the Committee. (See Attachment A for further discussion.)

2. A similar system to assist in tracking and analyzing the Federal R & D Budget. (See Attachment A for further discussion.)

I believe that some of these activities might be more flexibly managed on s small computer installed in my office and/or committee. This is especially true for those activities in which documents or data files may be created and managed locally; where access to a large computer or production printer is not required on a daily basis.

Given the complex nature of our representative and legislative responsibilities, it is no wonder that automated systems have become necessary tools in our day to day work.

Also, given the explosion of technology in automated systems which has occurred during these past several years, I would hope that the United States Senate could look forward to having at its fingertips the best tools the information systems industry has to offer.

CLOSING SALUTATION

In closing, Mr. Chairman, I would like to commend the Rules Committee for holding this hearing today. I assure you that I and my staff are eager to continue working with the Rules Committee to provide information that will be useful in determining the future course of automated systems for the Senate.

Senator, the following questions will be asked by Chairman Mathias after your testimony.

QUESTIONS AND ANSWERS

1. Chairman MATHIAS. "Senator Packwood, what benefits do you see coming from these additional services?"

Senator PACKWOOD. "Chairman, these additional services will enhance my effectiveness in helping the citizens of Oregon. In addition, these services will provide me with better control over the internal management of my office and the committee."

2. Chairman MATHIAS. "Senator Packwood, what kind of computer service is necessary to help manage and track the authorization, appropriation, and oversight interests of your Committee?"

Senator PACKWOOD. "Mr. Chairman, during the past two years we have used the Senate's Program Review System to crunch numbers and create reports. What we lack is a system that will provide us with the ability to store and retrieve not only budget statistics, but narratives, comments and other supporting information about those programs under our jurisdiction. I believe that computerized records processing might be of value in helping to solve this problem."

ATTACHMENT A

FEDERAL BUDGET PREPARATION AND ANALYSIS

The Commerce Committee has been an active user of the Program Review System (PRS) during the past two years. Currently, we are using this system to prepare periodic budget reports on those programs authorized by the Committee. We have also prepared a data file in order to track and analyze the Federal Research and Development (R&D) Budget.

We have found PRS to be a workable medium for preparing, contrasting, and computing on federal budget statistics. However, we have found that this system is not designed to provide sufficient space for fields of text necessary for narratives, comments, or documentation on inconsistencies in the federal budget process.

In order to test a full range of applications, I suggest that a prototype system include software similar to VISICALC or records-processing so that an alternate or parallel to the Program Review System may be evaluated.

PREPARED STATEMENT OF HON. TED STEVENS, A U.S. SENATOR FROM THE STATE OF ALASKA

Mr. CHAIRMAN. Thank you for the opportunity to discuss what I believe is an urgent need in the Senate to upgrade our office automation systems, particularly our word processing capability.

I have pending before the committee a request to be one of the Senate offices to test the IBM Displaywriter system, one of the many word processing systems available on the market today. My testimony here is not to argue in favor of the IBM system over any of the others, but to explain why the Senate's CMS (Communications Management System) has not met our needs and why a stand-along word processing system, such as the Displaywriter, is needed.

It's my understanding that senators who represent the most populous states are receiving about a half-million letters each year from constituents. As a senator from the state with the smallest population (400,000), I get in the neighborhood of 75,000 letters each year. My office is averaging between 5,000 and 7,000 letters each month. But while our total volume may be less than other offices, our production requirements are as great or greater.

I'm told that offices with the high volume of mail rely on "form" letters to answer the substantial part of constituent mail. Originally composed, or so-called ad hoc,

letters make up as little as 10 percent of the correspondence produced in some of those offices. We, on the other hand, of necessity rely on the ad hoc response for up to 80 percent or our outgoing mail. This is because we have more individual case letters per capita.

I was among the first Senate offices to subscribe to the Senate's CMS system, and we tried that system for two years. We found that it did not meet our needs, and in fact did considerable damage to our constituent relations. People at home did not like receiving "computer letters," and they let me know about it.

I understand that many improvements have been made to CMS since the days when my office participated, but the CMS system still basically remains one geared for the mass production of identical or form letters. For members receiving the half-million letters, the form responses may be the only alternative. For those of us representing states with many communities of very small populations, form letters are not acceptable. This leaves us with the limited option of using typewriters to produce our ad hac mail, and a choice of one of the Senate-approved stand-along systems to do our mass mailings. (We use the IBM System 6 for form letters, which by the way, I limit to responses to incoming form letters or petitions.)

In order to improve my office's capacity to handle correspondence, last year we purchased with 10 percent discretionary allowance System 6 consoles and mag card typewriters. The consoles, with video display terminals, are used to compose original letters, insert approved paragraphs, and revise text if necessary after I review the letter. The output from the consoles is on a mag card, which is printed by a mag card typewriter. (Just so there's no misunderstanding about the cost involved in the equipment we purchased, we did not buy new equipment, but rather refurbished machines at prices less than what an ordinary memory typewriter would cost.)

The additional System 6 equipment allowed us to improve our letter production significantly, but we are still far from having the capability that we should with what is available on the market today. By not being part of the Senate's CMS system, we do not receive CMS secondary benefits, such as computer printouts summarizing office correspondence output and automatic updating of mailing lists.

Advanced word processing equipment, such as the IBM Displaywriter, would permit us to have some of the ancillary benefits available to CMS users, while still permitting us to produce a high volume of ad hoc mail.

The reason we selected the IBM Displaywriter system over any of the others is that we're told that we would be able to integrate it with the System 6 and Mag Card equipment we currently have. The cost of the lease arrangement for this equipment would depend on the number of terminals and printers we incorporate into the system, but it would be under $2,000 per month.

Our constituents deserve prompt, substantive responses to their individual communication to us. An improved word processing capability for our offices would help us to meet that requirement.

U.S. SENATE,
Washington, D.C., December 9, 1982.

Hon. CHARLES McC. MATHIAS, Jr.,
Chairman, Committee on Rules and Administration,
Washington, D.C.

DEAR MR. CHAIRMAN: In response to your recent solicitation for comments on improving the Senate's computer capability, members of my staff have compiled the attached list of suggestions which would make its operation more useful for our purposes. As you may know, my offices use the CMS extensively for correspondence, memoranda, speeches and all written materials. Several members of my professional staff now utilize the CMS system instead of typewriters in their daily work.

1. Faster baud rate.—During the trial of the 1200 baud rate earlier this year, all users found this an absolutely indispensable feature.

2. Full screen editing.—The current line editor for text functions is very cumbersome and represents a major barrier to in-house training of new users of the system.

3. Autosav when the system goes down.—Many hours have been wasted and tempers ignited by the loss of text due to "unit disconnects." An automatic saving capability would obviate the need for repetitious saving or the delays experienced when using the "autosav=" format.

4. Simplified signing on.—A major barrier to such things as electronic note taking and use of CMS for small projects is the one or two minute delay involved in having to sign on or babysit the machine to put "hold" commands in every ten minutes. While a system that is always up would be preferable, even an extended "hold" capability (an hour or more) would be helpful.

5. Matching up terminal settings.—Since most users are interested in CMS, Legis and Scorpio as well as the Source and other future services, the problem of constantly changing settings is an annoyance, especially for the less computer proficient. Adapting the systems to allow a single setting arrangement would help.

6. More terminals.—A major setback in our efforts to "computerize" our legislative staff, which very much wants to go in that direction, has been the inability to get enough terminals for our needs. If the Rules Committee is serious about its intention to get the entire Senate onto the system, it had best provide the hardware for those who request it.

7. Standard set-ups.—Often our text files have standard formats which it would be helpful to store and utilize, to eliminate repetition. This is particularly true for tables or columns, which are very difficult to do currently.

8. Better spell capability.—The current dictionary is too small to make use of the spell function an efficient use of time. Currently it does not even include names of cities, states or countries or many members of Congress.

9. Simplicity for training.—No member of a professional staff should be required to spend 6–8 hours at the computer center in order to learn how to use CMS. My office has taken the initiative to teach its own people how to use the system. This wouldn't be necessary if the system were simple enough to operate so that it could be picked up quickly.

10. Computation capability.—This is not a common need but it would save staff time and money by increasing the number of available calculators.

11. Improving the A.J.—The selection of print wheels for the A.J. is very limited; although there are a dozen wheels available, their typefaces are virtually indistinguishable. Another drawback for the A.J. is the inability to change wheels during a text "runn" because typefaces would improve the appearance and effectiveness of final products.

The Senate is a large organization which deserves a computer systems which helps us do our job of representing people and studying issues with maxium efficiency. The current systems falls far short of that goal. With the growth and rapid technological change within the computer industry, I believe the Senate was ill-served by its current six-year contract, which is like a lifetime in this field. It is my hope that these and other suggestions can be incorporated in the new system so that the Senate can close the embarrassing office technology gap which exists between our selves and private industry.

With kind regards,

LOWELL WEICKER, Jr.,
U.S. Senator.

INTERNATIONAL BUSINESS MACHINES CORP.,
Armonk, N.Y., December 6, 1982.

Hon. CHARLES McC. MATHIAS, Jr.,
Chairman, Committee on Rules and Administration,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: I am pleased to submit the enclosed statement to the U.S. Senate Committee on Rules and Administration for the hearings scheduled on December 8, 1982 and request that this statement be included in the hearing record.

As I mentioned in my letter of December 1, 1982, I will be happy to personally discuss this topic with you on a future trip to Washington.

Best regards,

GEORGE B. BEITZEL.

Enclosure.

PREPARED STATEMENT OF MR. GEORGE B. BEITZEL, SENIOR VICE PRESIDENT, INTERNATIONAL BUSINESS MACHINES CORP.

Mr. Chairman and Members of the Committee: IBM is pleased to submit these comments to the United States Senate Committee on Rules and Administration which is seeking the advice of industry leaders in formulating its plans for computer and communications services for the Senate over the next several years.

For many years IBM has been recognized as a leader in meeting the administrative and information processing needs of organizations around the world. Today, we continue to apply that knowledge to the business requirements of tomorrow. Nowhere is this more apparent than in our strategic approach to office systems. All of IBM's office products have one specific and very important objective—to improve

the productivity of office workers: secretaries, administrative personnel, professional managers and the executive.

This statement will address the following areas:

The office environment today;

How we address these office requirements;

The future direction of the office;

And finally how IBM can assist the Senate.

Several statistics illustrate the challenge of the office systems environment today. It is estimated that by 1989, there will be 60 million office workers, comprised of 40 million managers and professionals, 13 million clerical and 7 million secretarial personnel.

This will represent over one-half of the total United States work force. These office workers have a variety of information requirements which include document handling, receipt of electronic mail, interaction with host data bases and local administrative processing.

The dollar investment in office systems during the 80's will be enormous. Some estimate that this investment will exceed $35 billion a year in the United States alone. The impact of these investments on the ability to make better decisions and to run organizations more efficiently will be unparalleled.

By the end of this decade, one out of every four workers in this country will have a workstation, half of which will be in the office environment. This growth reflects the significant potential for improving office workers' productivity. However, office automation to date has focused primarily on selected administrative and clerical functions. While an important first step, an equally important opportunity lies in enhancing professional productivity. In 1980, the firm of Booz, Allen and Hamilton concluded that office professionals spend 25 percent of their time on nonproductive activities. They further noted that, by 1985, presently available tools, such as word processing, information retrieval and document distribution, could save as much as 15 percent of the professional's time.

However, the needs for each professional will vary in accordance with specific responsibilities, location and function. In addition, some have requirements for access to information data bases, others for heavy text generation, still others for specialized capabilities such as graphics and in-house publishing. As a result, organizations are demanding a variety of workstations to address both professional and administrative support requirements. Office systems must be able to handle a variety of information types—data, text, image, voice and graphics—and provide the following capabilities:

Preparation of a variety of documents including memos, reports, mass mailings and budgets.

Filing, retrieval and distribution of these documents, as well as documents that originate from other sources, such as newspapers, external correspondence, handwritten notes and letters.

Graphical representation of text and data, such as pie diagrams and bar charts.

Personal services, such as facilities scheduling, calendar management and automatic follow-up.

Audio messages and distribution.

Traditional data processing capabilities.

Although office workers have many unique requirements, they have one requirement in common—the need to communicate. In order to accomplish their objectives, they need to share information and interact. The success of an office automation plan will be measured by its ability to address individual functional requirements and by how well it supports the sharing and interchange of information.

IBM has a wide variety of complete offerings which can be put together to form such a system. There are several fundamental elements of our office systems solution:

A diverse group of functional products from which users can select the best product to address their individual needs;

The capability for users to share and exchange information with other users of similar systems;

And, the capability to connect the various elements into a cohesive network which integrates data processing and office systems functions.

Many of IBM's office workstations have been optimized to address specific user environments, but all provide access to both data and text processing, eliminating the need for multiple workstations in an individual's office. The following are key elements to our office systems offerings.

The IBM Displaywriter is an important first step to an integrated office system. It can be used as a stand alone workstation for word processing as well as for personal computing. Then, if required, it can be connected to an office systems network for filing, retrieval, or distribution of documents. In addition, it can act as a data processing terminal connected to existing communication networks.

In the shared-logic environment, the 5520 Administrative System provides excellent word processing function, electronic document distribution and administrative records processing. Designed to support multiple users, the 5520 Administrative System can operate more effectively as a departmental system. In addition to its specifically designed word processing terminals, it will support the widely accepted IBM Personal Computer. As a result, a professional has full access to problem solving capability and word processing function at a single terminal.

The 8100 Distributed Office System adds shared logic word processing to a powerful data processing facility. In addition to operating as a departmental office system, the 8100 Distributed Office System is designed to work with existing networks to provide users with integrated word and data processing services through a single terminal. With software designed to be effective in the office environment, both professionals and secretaries have found the 8100 Distributed Office System easy to learn and operate.

As you can see, the Displaywriter, the 5520 Administrative System and the 8100 Distributed Office System address a variety of needs—from stand alone workstations to integrated word and data processing in a clustered environment. The result can be a dramatic improvement in user productivity for secretary and professional, whether part of a small or large organization.

While these solutions address documents prepared within an organization, users also need to access information contained in documents originating outside of the organization. Rekeying handwritten letters or magazine articles which have to be stored with other material is usually not practical or desirable.

The IBM Scanmaster I, IBM's newest office systems product offering, provides an answer to this need. The Scanmaster, I operating as a facsimile transmission device, can send and receive a high quality document image. But more importantly, the Scanmaster I can operate in conjunction with IBM's office systems products. As a result, image documents can be stored, retrieved and distributed across a network of Scanmasters, Displaywriters, 5520 Administrative Systems and 8100 Distributed Office Systems.

Fundamental to providing the required electronic filing and distribution function among systems is the Distributed Office Support System (DISOSS) designed to run on IBM host computers. DISOSS builds and maintains a single library of documents. Documents that were prepared on Displaywriters, 5520 Administrative Systems, 8100 Distributed Office Systems or scanned by the IBM Scanmaster I can be accessed. Powerful search techniques provide retrieval of these stored documents with such easy to use inquiries as "all memos, written by Jones, sent to Smith, during 1982," or "any document on the subject of energy, Northeast corridor, . . ." Additionally DISOSS provides electronic document distribution and extensive mail handling facilities such as logging, buck slips and tickler files. As a result, a document prepared or scanned on a workstation can be automatically transmitted at electronic speed to a single recipient or an entire distribution list.

Similarly, customers have implemented data processing applications for the professional which are currently accessed by existing terminals and Personal Computers. To preserve this investment while offering added text processing capability, IBM offers PROFS—the Professional Office Systems product.

PROFS provides electronic mail and personal or group calendar management as part of its professional support functions. In addition, the recently announced Displaywriter support allows secretaries and professionals to share and exchange information.

Although many documents will be handled electronically, there continues to be a need for printed output. IBM offers a variety of printers using impact, ink jet and laser technologies. Selection criteria include print speed, print quality, requirement for envelopes handling, mult-font printing and collating requirements, among others.

The IBM 6670 Information Distributor is a particularly powerful printer offering. Using laser technology, it can print documents prepared by Displaywriters, 5520 Administrative Systems or 8100 Distributed Office Systems. Multiple type styles can be printed on a single page, printing can appear on both sides of a page and multiple copies can be automatically collated. The high quality output can be distributed to any 6670 Information Distributor attached to the network of IBM office systems.

In most offices, voice communication, particularly telephone communication consumes a major portion of user activity. IBM's Audio Distribution System (ADS) can improve professional productivity by eliminating redundant, non-productive telephone usage. With a few very easy-to-use functions, users can record a telephone message and ADS will automatically route that message to an individual or to a distribution list. Once received, a message, in the sender's voice, can be saved, repeated or redistributed. Access to ADS is secured via passwords but is available from any telephone.

ADS improves productivity by addressing the familiar difficulties in voice communication—telephone tag with people who are busy or not available.

In order to ensure a rapid, efficient and error-free exchange of information, products must adhere to a set of communications rules which provide a framework to interconncect multiple systems and devices, and allow sharing of various types of user information. When properly designed, these rules or architectures will accommodate new technologies while preserving user's existing invesments. The recently announced Scanmaster I exemplifies this flexibility. IBM has established and documented a set of architectures, which fall into 3 categories.

The Document Content Architecture (DCA) is a structure for viewing, printing and revising documents across a variety of workstations. DCA ensures that the content and format of a document is protected during and after transmission.

The Document Interchange Architectures (DIA) provides distribution functions, such as the names of the sender, receiver and copyees; distribution lists, routing information, priorities, acknowledgement and document classification. It interprets all of the information associated with a document in order to ensure that it reaches its destination.

Systems Network Architecture (SNA) provides the facility for transporting a document. Utilizing existing common carrier or private networks, SNA enables the physical connection between devices. SNA enjoys wide usage for data communication today and as the backbone of a communication system, provides connectivity, detection and increased line efficiency.

These architectures or rules allow for non-disruptive growth of existing as well as future office systems offerings. They are documented and used by IBM's laboratories in developing new office systems products as well as enhancements to connect products.

In summary, this is look at IBM's office systems offerings and their ability to meet the needs of a variety of users. As individual products, they have significant potential for improving productivity.

Users can select the best product for their own needs with the confidence that it can participate as part of an integrated system for distributing and sharing information among a variety of workstations in the network.

IBM recognizes that significant investments have already been made in data processing and communications networks and that these systems are delivering valuable functions today. Implementation of office systems using Systems Network Architecture further extends that investment by allowing these systems to access existing data bases.

With this current technology as background, we will not take a look at office automation in the future.

In the near term, office systems workstations will be installed at an accelerated rate. Additional functions, such as aids for grammar, style, content and personal directories will be added to existing products.

More word processing functions will be added to Personal Computers and more data processing functions added to word processors. With wider acceptance of these workstations, the need for enhanced interchange will be addressed.

Voice, which is today digitized by the Audio Distribution System, will be incorporated into existing text, data and image handling systems.

The rapid growth in the number of terminals and varying forms of information will lead to a more critical need to plan for physically connecting these devices within a building. Existing wiring options may not be able to handle future volumes of data, text, voice, graphics and video information. Furthermore, wiring a building is costly, requiring careful planning and a need to be compatible with external communication facilities. IBM is actively pursuing solutions that not only meet the requirements of all information types, but handle a wide range of terminals, are easy to install and can provide systems management functions at a competitive cost.

The Local Area Network (LAN) will be a critical communications element in any future system with multiple locations. IBM has participated actively in developing LAN standards with the IEEE 802 Committee and has submitted five papers on the "token passing ring" concept. In addition, we recently announced a joint develop-

ment contract with Texas Instruments to develop certain components for such a network.

Longer term technology advances are anticipated in the industry to deliver a terminal which can be neatly packaged, if desired, as part of a person's desk. These workstations will incorporate voice, text, data, image and graphics capabilities.

Voice recognition, an identification method as precise as fingerprints, will assure security and can automatically transform the spoken word into the printed word.

Immediate access to internal or external data bases will be available easily by touching a few keys.

Video teleconferencing will significantly reduce the amount of travel required.

Portable terminals will be compact enough to fit into a briefcase when travel or work at home is required.

While there are many views as to what the future holds in the office arena, there is general agreement that evolution to his future environment requires careful planning, cost justification and the capability to install office solutions as smoothly as possible.

If introduction of new products is viewed as a revolution and does not provide value to your users and is difficult to use, then your office automation plan will not succeed.

To be successful, you must begin by understanding the alternatives available and then begin to implement the needed solution. Fundamentally, you must start with a plan setting out your objectives, responsible individuals, target users, benefits evalutions criteria and most importantly, your timetable. Methodologies, such as the IBM Application Transfer Team, exist to help you develop such a plan. Pilots in several different areas should be established and evaluated.

Education at all levels, executives and secretaries, should be conducted to assure a consistent set of expectations and capabilities.

IBM has a local team specifically responsible for delivering support to the United States Senate. Specialists in such areas as communications, data bases and office applications are available to work with you in planning and implementing office systems. This team will ensure that appropriate planning, education and technical resources and utilized at all stages of your plan. This support can help define and implement office systems which deliver value to the United States Senate.

To summarize, we've looked at office automation requirements and concluded that, while the opportunity is large, the needs are broad and varied.

We believe you will agree that IBM offers a broad and varied product line and that these products are each individually rich in function. Equally important is the ability for these products to share and exchange information and to take advantage of existing data processing and communication facilities. We can provide 25 years experience in information processing, over 40 years experience in office products area and 15 years experience in network design and management for you office automation plan.

Thank you for the opportunity to submit this statement.

TYMSHARE,
Cupertino, Calif., December 8, 1982.

Hon. CHARLES MCC. MATHIAS, Jr.,
U.S. Senate, Washington, D.C.

SIR: The attached is Tymshare's statement for the record for the December 8, 1982, hearing of the Committee on Rules and Administration. This addresses our plans for computer and communications services over the next several years, specifically in the area of office automation.

We hope this concise statement and its referenced documents are useful to the Senate in formulating your plans for the future.

If we can be of additional help please feel free to contact us.

Very truly yours,

LASZLO RAKOCZI,
Group Vice President.

WALTER J. EISSMANN,
Division Vice President.

Enclosures.

STATEMENT FOR THE COMMITTEE ON RULES AND ADMINISTRATION

Tymshare, Inc. has been actively involved in remote computing and communications services since 1966. We have grown significantly in this time frame based upon providing value added services to industry, government, and financial clients.

For the past five years we have been directly involved with improving knowledge worker productivity. We acquired a software product, AUGMENT, from the Stanford Research Institute and have continued its development.

Software will prove to be one of the major factors for the future. A Universal Mail System which links multiple networks together will improve communications significantly. This system must incorporate an identification system that is without bounds. It, of course, will be multi-host and will be compatible with many different main-frames. It will incorporate the ability to reachthrough to many hosts on many networks.

This electronic mail system will include an excellent document control system. It will allow collaboration from many different geographical locations on sophisticated documents. It will incorporate excellent editing capabilities to improve knowledge worker productivity. Document tracing, tickler files, and other standard applications will be included.

There will be the ability to output drafts of documents to laser printers. Final documents will be prepared directly, ready for photocomposition devices to prepare camera ready copy for large printings.

This system will also encompass Relational Data Base Management Systems and sophisticated Decision Support Systems. There must be communication capabilities between these integrated systems.

Conferencing is another capability that will enhance knowledge worker productivity. Computer teleconferencing may involve simultaneous on line users or may be periodic through reading and updating files at times that users find convenient. It may include a voice conference call in conjunction with a video conference system to display documents, graphics, etc.

This has led Tymshare into the area of High Performance Knowledge Workers. By providing groups of individuals with high technology capabilities including intelligent video display units (VDU), sophisticated human engineered software tools, training by experienced teachers, state of the art communications capability, large scale computer hardware with interface to data bases, and the skills, knowledge, and methodology to effectively utilize this elaborate total system we can achieve tremendously improved productivity.

Attachment I is excerpted from a developing document by Dr. Douglas C. Engelbart entitled "Viewports Into Tomorrow's Knowledge Workshop". It includes some background on our experience in this area, as well as thoughts about the integration of the coming technologies for the benefit of mankind. Upon the completion of this document we would be willing to include you on our distribution at your request.

Attachment II is from a report which Tymshare prepared for the Rome Air Development Center authored by Dr. Douglas C. Engelbart. It is more detailed in certain respects relative to the User Interface System, Procedure-Call Protocols, etc. Therefore, we have only included the Executive Summary. Other parts of this document detail the requirements for each user to be involved throughout the entire life cycle of an information system project. This includes from initial conception, through research and development, and to final implementation of the information system. This continuity enhances the probability for success of the project. The use of these High Performance tools reduces the time from conception to actual implementation due to increased productivity. We strongly urge that pilot workshops must be set up to further investigate the organizational ramifications on the individuals involved on these teams.

Tymshare also has extensive experience in the area of computer communications through its TYMNET subsidiary. This public network utilizes packet switched technology to transfer data between users and computers. Within this network a supervisor computer controls several hundred other computer nodes, known as TYMNET Engines, which communicate with each other, with host computers, and with terminals. These TYMNET Engines include error detection and retransmission of data to insure reliability and integrity of the data. They also pass through data from other nodes. Redundant circuits from your local node to your host computer increases your total uptime.

TYMNET interfaces to several international record carriers to allow total global communication on a reliable basis. Satellite transmission is being utilized between computer centers for large volumes of data. Facsimile transmission will be added in

the future. Business color graphics transmission is becoming a reality as technology advances.

TYMNET has also supplied many private data networks for customers which tie all of their computers together on one network. This private network can then interconnected to the public network by a gateway through a TYMNET Engine. We have such advanced telecommunications capabilities that we would need even more time to adequately cover this topic.

There are also other areas that we could cover for you including microminiaturization of components for terminals, communication devices, main frames, etc. This has led to the increased intelligence that can be placed in personal computers and the use of these devices for communicating with very large systems. Also the development of unique terminals that incorporate a pointing device known as a mouse for moving the cursor on a video display unit.

However, we hope what we have covered in this statement is what was desired by the Senate. We are certainly willing to expound on specific items if you so desire.

ATTACHMENT I

DRAFT

Title: Viewports Into Tomorrow's Knowledge Workshop.
Author: Douglas C. Engelbart, Tymshare, Inc., Cupertino, Calif.

INTRODUCTION

By a long, evolutionary series of inventions, humans have parlayed their basic mental, motor and perceptual capabilities into a relatively effective system for doing hard knowledge work. While our underlying biological machinery supposedly hasn't changed appreciably over the known part of our history, our culture in some exponential way struggled upward and into possession of our current, "highly developed" institutions of science, commerce, industry, complex political and economic systems, etc.

Why the quotes around "highly developed"? Because I stoutly believe that when the forthcoming technologies have been properly integrated into our changed human ways of thinking and working, the consequent human institutions will reflect capabilities for learning and understanding, and for dealing with complexity and urgency, that far exceed any of today's expectations (including mine).

I think that humans are now coming into possession of the means both to extend immensely the limits that these human capabilities can reach, and to accelerate significantly the rate at which we can improve them.

And I believe that the visual display terminal will play a very prominent role in these changes.

I have carried these beliefs for many years, and built a struggling career of sorts around the pursuit of the potential that they tell me is there. In the late Fifties, art SRI International (then called Stanford Research Institute), I was given a grant from the Air Force Office of Scientific Research that enabled me to spend several years trying to turn those beliefs into a framework concrete enough to guide a research program. The results were published in 1962 and 1963, [1] and [2], as "A conceptual Framework Toward Augmenting The Human Intellect." Although these publications somehow failed to awaken the rest of the world to the immensity of this dawning opportunity, the effect on me was to raise an erstwhile hypothesis to the level of an internal certainty—a mental condition which may well be locked in place for life.

Over the following years I was fortunate enough to get considerable support from NASA and the Defense Department (DARPA and RADC). I founded a laboratory at SRI which when large enough to warrant a name became the Augmentation Research Center, and pursued a course of pragmatic evolution toward "augmenting the human intellect." My colleagues and I evolved a comprehensive computer system to give interactive support to visual display terminals (VDTs). A short historical sketch and an overview of the research results are published in [3], and in embellished form in [4]. In 1978, SRI transferred commercial rights to Tymshare, Inc. of Cupertino, California, where the system is being marketed under the name AUGMENT, and where implementation of the architectural principles outline below has been completed.

CONCEPT OF THE KNOWLEDGE WORKSHOP

My first introduction to the term "knowledge work" came from a book by Peter Drucker [5] in the late Sixties. Considering knowledge to be the systematic organization of information and concepts, he defined the knowledge worker as the person who creates and applies knowledge to productive ends, in contrast to an "intellectual" for whom information and concepts may only have importance because they interest him, or to the manual worker who applies manual skills or brawn. In those two books Drucker brought out many significant facts and considerations highly relevant to the theme here, one among them (paraphrased below) being the accelerating rate at which knowledge and knowledge work were coming to dominate the working activity of our society:

In 1900 the majority and largest single group of Americans obtained their livelihood from the farm. By 1940 the largest single group was industrial workers, especially semiskilled machine operators. By 1960, the largest single group was professional, managerial, and technical—that is, knowledge workers. By 1975–80 this group would come to embrace the majority of Americans. The productivity of knowledge had already become the key to national productivity, competitive strength, and economic achievement, according to Drucker. It is knowledge, not land, raw materials, or capital, that has become the central factor in production.

In his provocative discussions, Drucker made extensive use of such terms as "knowledge organizations," "knowledge technologies," and "knowledge societies." It seemed a highly appropriate extension for us to coin "knowledge workshop" for renaming the area of our special interest: the place in which knowledge workers do their work. Knowledge workshops have existed for centuries, but our special concern was in their systematic improvement, toward increased effectiveness of a new breed of craftsmen who would work in an "augmented knowledge workshop."

Improving the effectiveness of knowledge workers involves systematic change not only in the workshop's tools, which help handle and transform the materials, but also in the customs, conventions, skills, procedures, working methods, organizational roles, training, etc. by which the workers and their organizations harness their tools, their skills, and their knowledge in the pursuit of human goals.

Since this pursuit involves automating many erstwhile human operations, what we pursued could have been termed "workshop automation." ("Office Automation" hadn't emerged as a common term at that time.) But because we attributed so much importance to other innovations besides the new tools (e.g. conventions, methods, roles) we preferred instead to use the term "augmentation," hopefully to remain "whole-scope" about this pursuit of higher performance capabilities. We wanted to keep tools in proper perspective within the total system that augments the capability of knowledge workers and their organizations.

THE OVER-ALL AUGMENTATION SYSTEM

The categories of system elements

The difference between "automating" our knowledge workers and "augmenting" them can be brought out by considering the larger system of inter-dependent elements that enable humans and their organizations to harness the native human capabilities toward effective knowledge-work results.

For the following discussion, a "craftsman" metaphor seems directly applicable. It is directly compatible with the "workshop" terminology; and with a bit of use, the term provides some very valid perceptions—for example, that our knowledge workers must be very much the professional craftsmen.

Here, from my framework, are the major system elements involved in "augmenting" our knowledge workers and their organizations.

A. Tools: Craftsmen benefit from balanced collections of well-designed tools.

B. Methods: To be effective, tools must be used with well-polished work methods.

C. Skills: It takes practised skill to exercise a competent blend of tool and method.

D. Knowledge: True craftsmen depend upon much integrated "shop" knowledge.

E. Language of the Craft: Craftsen need an effective language to discuss, teach, plan and collaborate among themselves (i.e. to do their "shop talk").

F. Training: To develop an effective group of craftsmen in a planned way requires explicit training, in all of the above elements.

G. Organization: Role differentiation and organizational structure are necessary for integrating craftsmen effectively into an organization.

Tool system and human system

For discussion sake, call Category A the "Tool System" and the aggregate of Categories B through G the "Human System." We can immediately note that new technology, no matter how dramatic, contributes directly only to the Tool System.

Over the centuries there has been an immense amount of invention involved in the cultural evolution that brought the Human System to its present state. But its evolution took place with what will have to be described as a very primitive Tool System.

To take advantage of the absolutely radical character of the emerging Tool-System inventions, it is inevitable that evolution of the Human-System will begin to accelerate. In my view, this is strongly to be encouraged, since the power derived from the Tool System can only come from the way it is harnessed to human endeavors via the Human System.

There is a prevalent dictum whose unquestioned advocacy has been a great source of distress to me. It says that computer tools should be "Easy to Learn and Natural to Use." With reasonable qualifiers attached, such a dictum would be quite acceptable: yes, for a given level of functional capability, the cost of learning should be balanced along with other costs against perceived payoff—and when mastered, the use should seem natural and unstrained.

I can't really blame a product planner or a marketing manager for blindly pushing such a dictum when it is so prevalent. Their job is to capture as large a share of the market as they can, and if the market is singing that tune, it is only sensible to join in.

Whom I do blame, though, for shorting our future, are the consultants and researchers who blindly support this dictum; and I am also disappointed in the user-organization representatives who go along—but if they don't purport to be experts, I forgive them. What am I concerned about? Well, an analogy would go like this: "If we had so blindly followed such a dictum during the emergence of self-propelled vehicles, we would all be riding tricycles instead of bicycles." In such an important area of human activity, society simply can't afford to maintain an attitude that locks us into the knowledge-tool equivalent of the tricycle.

I think that our focus should be on what these radical new tools OFFER us in the way of OPPORTUNITIES to change our Human System, toward considerable more capability in pursuing human goals. We should be exploring and evaluating the possible changes, not blindly fighting them.

I would also offer this hypothesis, regarding tools past and future: the more valuable the tool, the more change it is likely to bring about in the way we do things.

Co-evolution

The optimum design for either the Tool System or the Human System is heavily dependent upon the match it must make with the other. There is a high degree of mutual dependence.

To be pragmatic about it, nobody knows enough today to specify either the Tool System or the Human System for a progressive organization of five years hence; and the lead time for design and implementation is at least that long. The answer? Evolution. By the best guesses we can make. And in making the evolutionary steps within each the Tool System and the User System, we need to make a conscious effort not just to track the changes in the other system, but to anticipte them.

So, the ultimate capability of the larger "Augmentation System," and therefore the performance level of the knowledge workers and knowledge organizations of the future, will improve only through the co-evolution of these two sub-systems.

A disastrous default mode would be for the evolution of the Tool System to be steered unilaterally by the perceptions of the technologists and the market-oriented product planners, leaving the Human System to adapt in its trail.

There seems to be no practical counter-concern, that the evolution of the Human System will unilaterally drive that of the Tool System; in our society, it isn't likely that the Human System could be served by analysts, inventors and entrepreneurs with the same fierce intensity as for the Tool System.

There is a need for explicit, conscious invention and evolution in the Human System. It is predominantly the tool users and their organizations who must do this. But there isn't yet a significant foundation in the business and work culture of our organizations to foster evolutionary pursuit on the scale called for by the opportunity at hand. Not until there is a perception of significant return from investments in Human-System evolution will be escape from the technology- and vendor-driven mode of change.

It is something of a bind—our culture hasn't realy developed an acceptance for "progress" in this Human-System domain, at least not to anything like the degree

with which it embraces the concept for technology-based material progress. And indeed, without a solid perception and acceptance that conscious evolution of such as this Human System (primarily a cultural matter) will pay off, we are not likely to become particularly effective at it. So it would seem that we need to invest an extra degree of attention and resource toward developing the perception that explicit Human-system development is not only acceptable but has a very high payoff. Then we probably could get moving toward a balanced co-evolution.

There are a number of things that an organization can do to attend seriously to the evolution of the Human components of its Augmentation System. A brief, general discussion of these is given later in this chapter (see also Peter Keen's chapter in this book, and my article in Ref [4]).

The next two sections below deal with characteristics of the Tool-System architecture that seem improtant for pragmatic pursuit of high-payoff augmentation through a co-evolutionary process.

BASIC ASSUMPTIONS ABOUT THE COMPUTER-BASED TOOL SYSTEM

Embedded in a computer network

It seems inevitable that, as depicted in Figure 1, there will be a combination of local, high-speed networking (Electronic PBX and Local-Area Network) together with higher-level networks (private and public) which will interconnect workstations and the many tools and services within an organization's "whole workshop." The effect will be monolithic transportation system—not unlike a system of federal, state, county, toll, and private roadways—where some elements seem far away (i.e. a slow or expensive transportation path) and some seem very close (i.e. a fast and cheap transportation path).

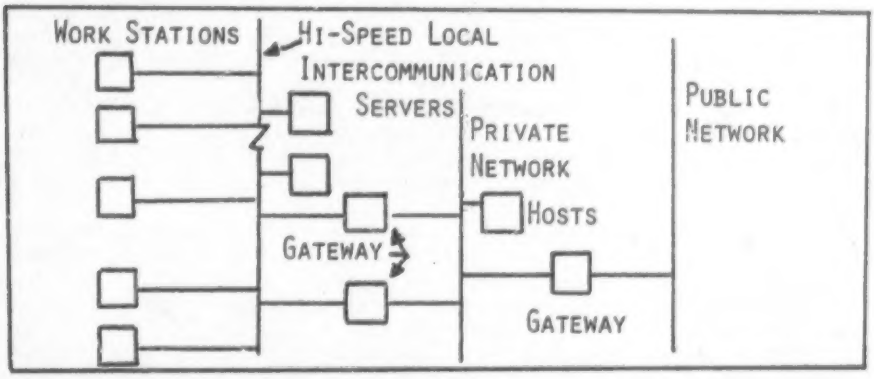

FIGURE 1.—The workstations, computers and data bases for most large organizations will be interconnected something like this, and will connect to the outside world via at least one public network.

For the purposes of this discussion, let us put aside concerns for how much processing power and storage capacity should be built into the workstation, or where any particular programs or data should reside. To the worker at his VDT workstation, there are merely two classes of tools and services, those which are integrated into his workshop, and those which aren't (yet).

And the architect who selects the tools and services, and organizes them into a coherent workshop, will possibly have a slightly enlarged view of things. As indicated by Fig. 2, in an important sense, the architect will come to think of tools as being near or not near in terms more of whether they serve the set of core-workshop functions than of their physical or electrical distance from the worker's terminal.

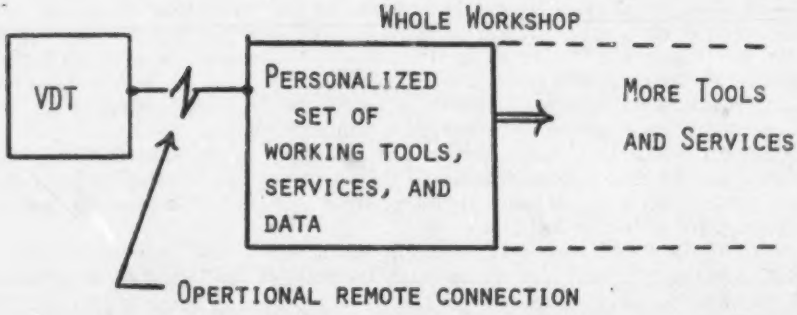

FIGURE 2.—The worker's view of his Knowledge Workshop—looking through his VDT "viewport" into a large, multi-tool workshop. He knows that more tools and services exist than are integrated into his personal tool set, and he knows that the "boundary" can be changed for him to enlarge his personal set.

Let us consider the following principles, relative to supporting tomorrow's knowledge workers and integrating their capabilities into the knowledge organizations:

Their workstations should have access to many tools and services, assumedly provided by a number of distributed sources around this network, including both those newly implemented and those that have long existed and will be slow to disappear.

The personalized collection of tools and services for each worker should be integrated into what is seen as a coherent whole—into his own, "augmented knowledge workshop." The worker would generally understand that many more tools and services are out there, and that his current tool set can be expanded (or contracted) as needed.

Each worker should have access to his full complement of tools, services, and personal working files from other workstations—away from home base, even across the country—so he can carry on with his work wherever he happens to be. (It would be a silly rejection of available communication technology to do otherwise.)

This whole arrangement must provide pragmatically for continuing evolution of command language, tool and service functions, terminal hardware, processor horsepower, application packages and their support computers, etc.

(See Reference [6] for a full development of such principles, and for the foundations for the architecture described below.)

Once a worker is thus operating within this network environment (a "digital-packet transportation system"), it becomes possible to reach out through the interfacing processor(s) to access other people and other services scattered throughout a "community," and the "labor marketplace" where he transacts his knowledge work literally will not have to be affected by geographical location.

Specialty application systems will exist in the way that specialty shops and services now do—and for the same reasons. When it is easy to transport the material and negotiate for services, one group of people will find that specialization can improve the cost effectiveness of their products and/or services, and that there is a large enough market within reach to support them.

In this new environment, an option will often be available that was much less available in the industrial processing market: in many cases it will be feasible for the service agent to ship his specialty processing tools (programs) to you so that you can process your material (data) at your site (in your computer), rather than having you ship your material to his site for processing.

The nature of knowledge-based service transactions will change immensely. For instance, there will be a very significant increase in the speed and flexibility with which the direct services of specialty people can be negotiated and harnessed.

So the specialty shops will flourish, but many involve much less of the application of unique tools within the distant specialty shop than of the application of special knowlege and skills of distant specialty people.

An explicit, core-workshop domain

Many different tools have already emerged to support a knowledge worker at a VDT. For example: editing, electronic mail, document typesetting, data-base management, spread-sheet calculation, business-graphic generation, and computer-aided design. The trend to date is for each of these to be a stand-alone software package, where each may employ its own conventions for control, its own terminology and syntax for commands, and its own unique way in which a user must conceptualize what is going on behind the VDT screen.

And often each will have its own unique file structure, so that for instance one could not easily integrate his spread-sheet data into a document, or send a copy of the data to a colleague via his electronic mail system.

Even if two tools happened to use compatible files, there often is unnecessary user overhead in shifting from working on a file with one tool to working on that same file with the other tool. Generally this involves shifting the entire context—i.e. loading the new-tool program, and then loading that file (again) into the new tool's working space, and then finding one's working position within that file (again).

Later in this chapter I will describe how these different kinds of tools can and should be integrated into a coherent working environment, which remedies most of the foregoing problems.

What I would like to bring out at this point, though, is the concept of "core knowledge work" and a "core workshop" whose tools are designed to support the core knowledge work.

Within each tool, such as those listed above, can be found a number of basic operations which are common to many of the others. For instance, each must provide means to compose, study and modify its files. Each must provide means to manage its files—creating, updating, re-naming, copying, deleting, etc. Each must provide a command language, generally having unique conventions for control and syntax, and employing a unique terminology.

Following the current trend, these special-purpose application systems would continue to evolve, often by adding useful features outside their immediate special application area. There would be an increasing amount of overlap in features supporting general knowledge-work.

An alternative approach, developed more completely below, is to recognize the de facto existence of a "Core Knowledge Workshop" domain—and to develop a special application system aimed expressly at supporting its basic knowledge-work functions. One important requirement of a tool sub-system to support this "core knowledge workshop" is to interface usefully with other, specialized systems.

Figure 3 provides an expansion of the "whole workshop" view, to represent this dichotomy of "core tools" and "special tools." Perhaps the knowledge worker at his VDT will be unaware of which of his workshop functions are derived from his core set of tools, but the people who organize his workshop for him certainly will.

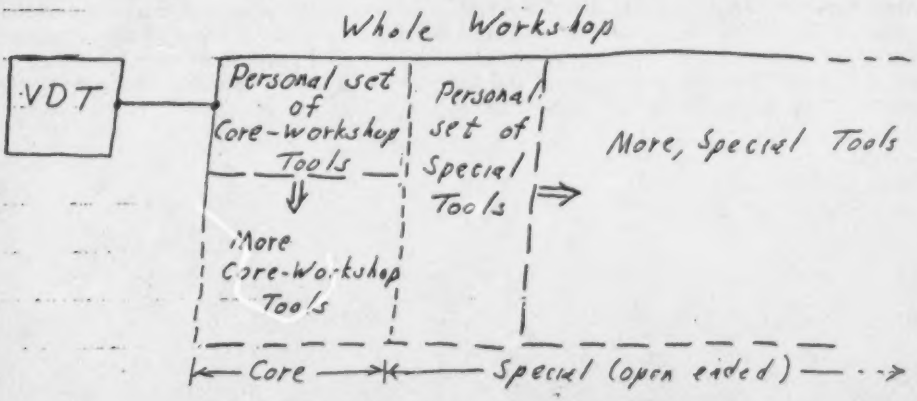

FIGURE 3.—The Workshop architect, faced with integrating functions from many tools into a worker's personal tool set, will probably have this view of things.

Coordinated set of user interface principles

As seen by a given knowledge worker, the whole knowledge workshop, over all of its tool and application areas, should have a common set of principles affecting user interface features such as the language, control conventions, and methods for obtaining help and computer-aided training.

This requirement has two main implications. One, it means that while each domain within the core workshop area or within a specialized applications system may have a vocabulary unique to its area, this vocabulary will be used within language and control structures common throughout the workshop system. A user will learn to use additional functions by increasing his vocabulary, not by having to learn separate "foreign" languages. Two, when in trouble, he will invoke help or tutorial functions in a standard way.

Grades of user proficiency

Even a once-in-a-while user with a minimum of learning should be able to get a few straightforward things done. In fact, even an expert user in one domain will be a novice in others that he uses infrequently. Attention to novice-oriented features is important now, but over the years it will have decreasing importance as the general, expected proficiency of workers increases. (For instance, what special features are built into today's automobile solely to benefit the learning driver?).

But workers also deserve the reward of increased proficiency and capability from improvements in skills and knowledge. And here we must recognize that their tool-application proficiency is affected by skills and knowledge beyond just those associated with tool operation; the ability to understand, learn and apply many features in a system of tools is affected directly by a worker's associated degree of skill and knowledge in the substantive problem domain and also in the other "human system" elements—methods, conventions, vocabularies, etc. "Advanced features" in every tool domain will be important, and indeed, unavoidable.

A corollary feature is that when elements of their Tool and Human systems are rapidly evolving, workers need continuous coaching and training in order that their skills and knowledge may harness the available tools and methodology effectively. It is therefore more important than seems generally recognized to equip our knowledge Workships with interactive tools that provide help and training over the knowledge and skills required in both the Human and the Tool systems.

Easy addition of, and communication between, workshop domains

It must be easy for the worker to transfer operations between one tool domain and another, and it must be easy to communicate the work results from operations within one tool domain to those of another.

Also, it should be easy to add or interface new domains to the workshop.

To illustrate the foregoing set of design goals, consider three representative types of workers and the mix of tools and services that might be integrated into what each sees as "My Workshop." If the integration of the tool and service functions were done properly for each of these people, the command language that elicited the range of "My Workshop" functions would be coherent and uniform in concept, terminology and syntax—and none of these workers would need to know which among all of the computers and programs and data bases in the Whole Workshop were involved in carrying out any given command.

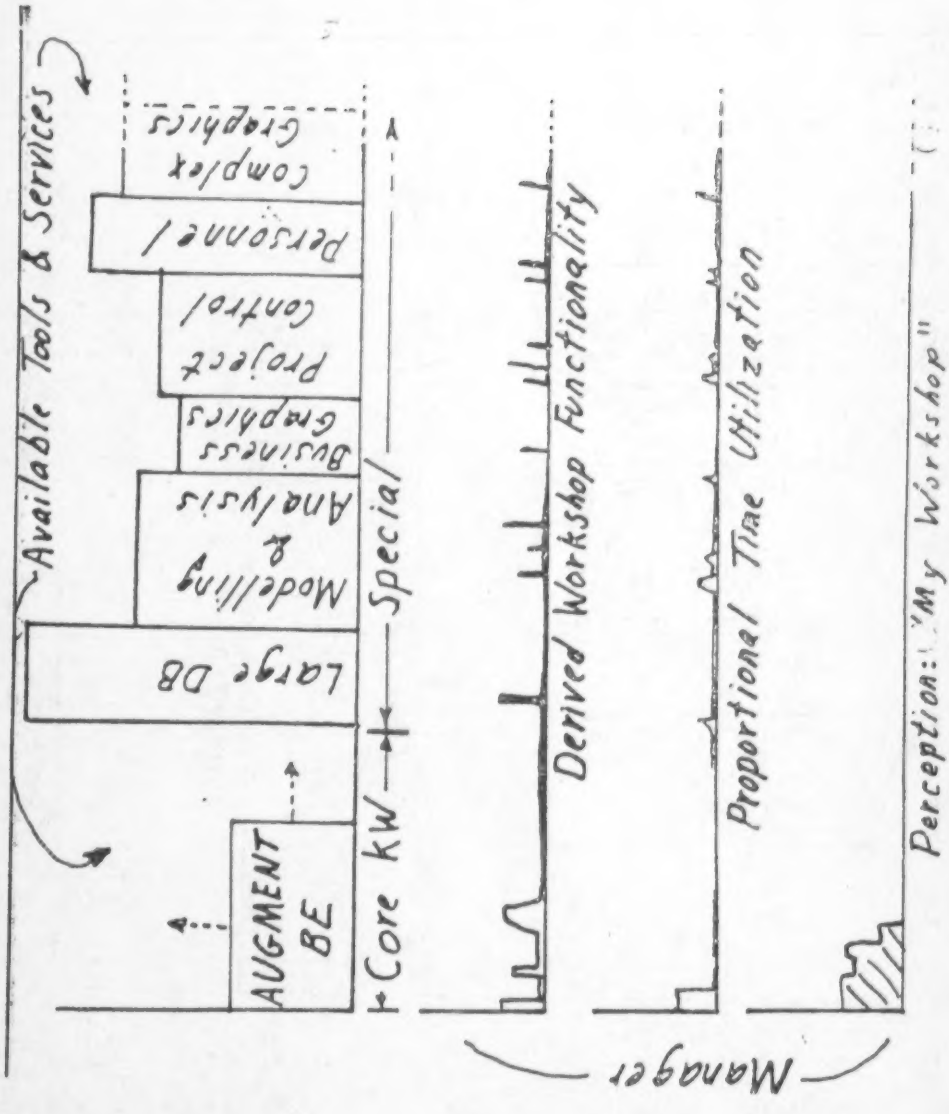

FIGURE 4.—Depiction of the makeup of a coherent, integrated set of tools and services as organized for a manager. The component functions are extracted from a spectrum of explicit tools and services distributed "out in the Whole Workshop," but the manager thinks of the results as "My Workshop".

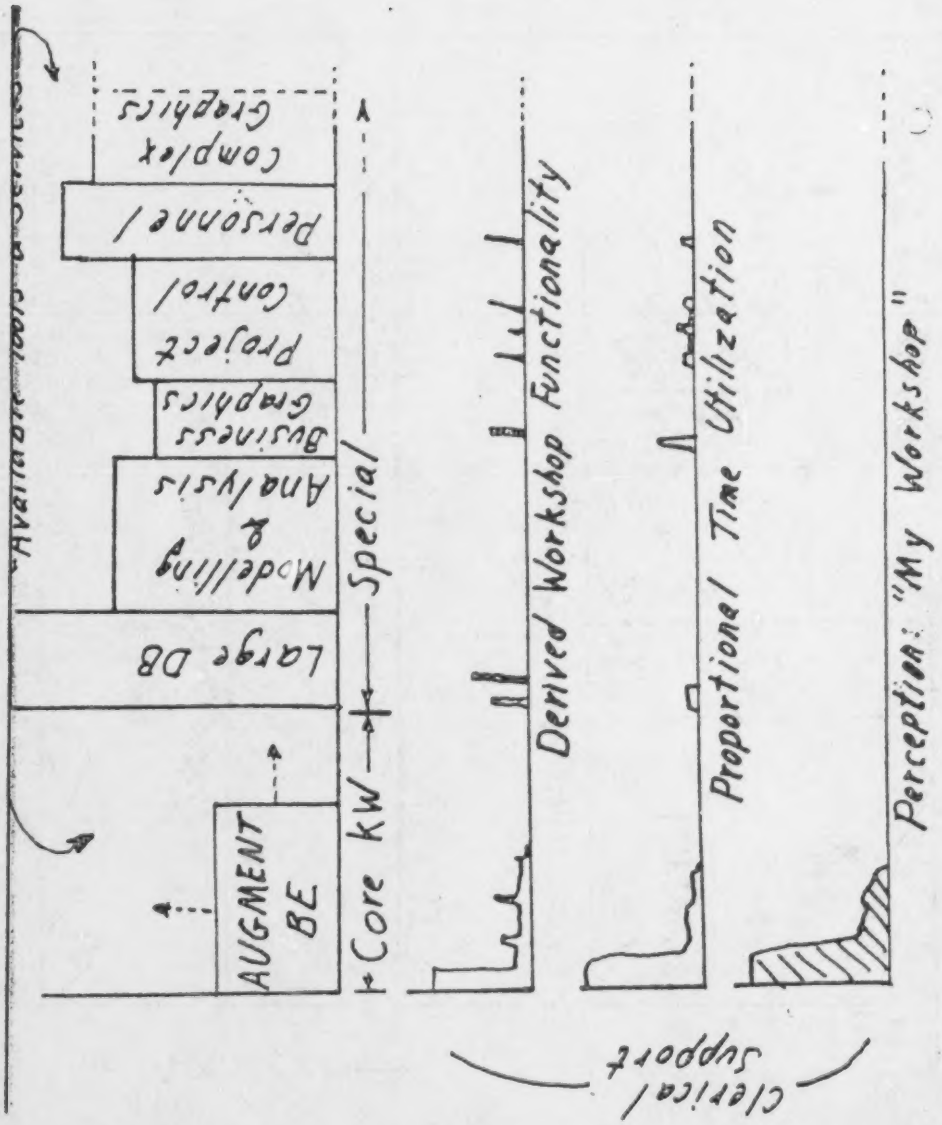

FIGURE 5.—Depiction of the makeup of a coherent, integrated set of tools and services as organized for a clerical support person. A different workplace, with a different set of functions and a different size and nature of command vocabulary from the manager's Workshop.

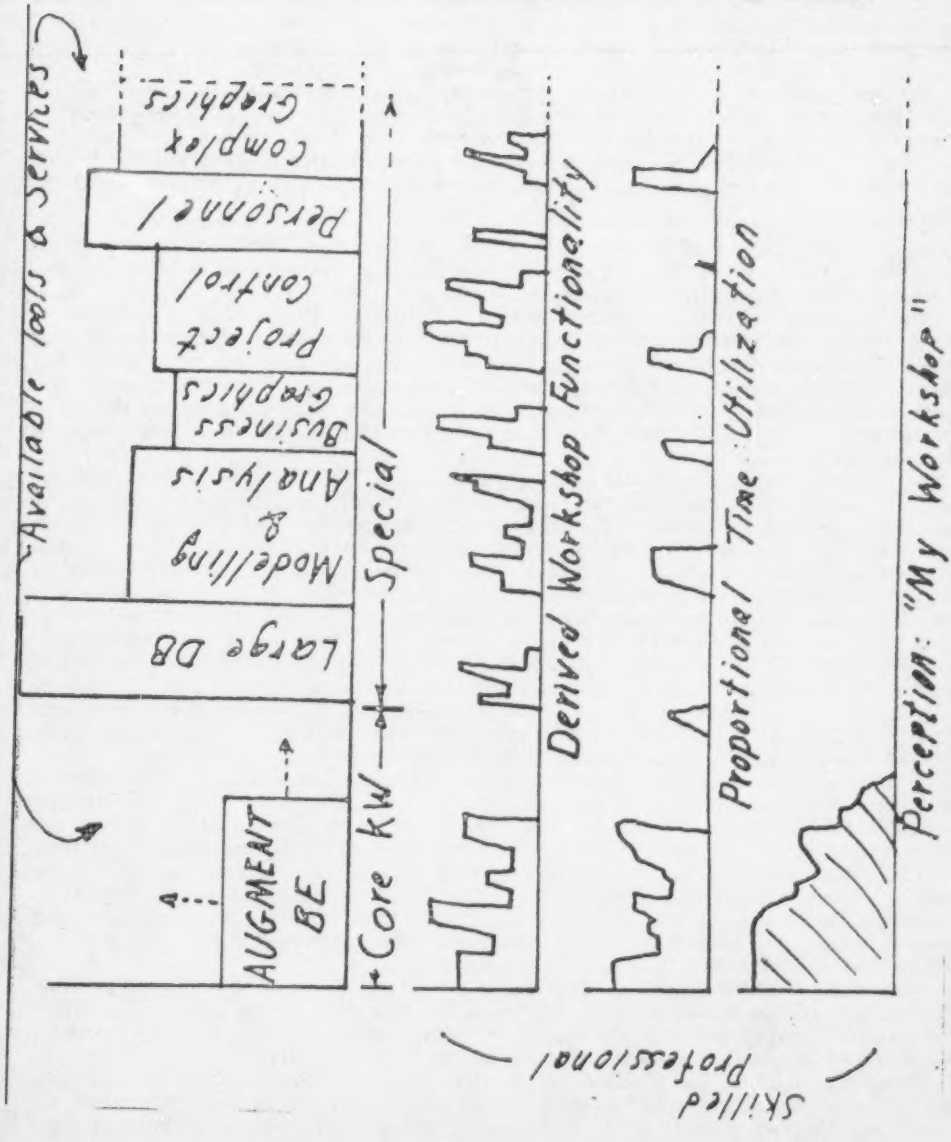

FIGURE 6.—Depiction of the makeup of a coherent, integrated set of tools and services as organized for a high-capability professional whose working role and methods involve much heavier utilization of available Workshop functions. His shop-language vocabulary would be considerably more extensive than for the manager or clerical person.

User programming capability

Practical support of the co-evolutionary principle means in my mind that a steady change process would occur in the tool features (for many years to come). An important part of the change process will be that done by cut-and-try extensions and modifications generated out on the "worker front." It must therefore be possible, with various levels of ease, for minimally trained "programmers" to add new tools, and to extend the features of existing tools language, to match an evolving set of Human-System elements. There should be options to do this in any of a variety of programming languages with which they may have training. A special requirement in this regard is a complete facility for "user programming" in the basic user-level language of the workshop itself.

The worker should be able to write executable programs in the form of sequences of written statements that employ the same commands as he employs interactively with his tools. There should be provision in the program statements for testing and conditional branching, and support in the execution processor for debugging. These programs must be easily composed, commented, studied, tested and modified—as standard parts of one's working files, and employing the standard tools otherwise used for composing, studying and modifying such files.

This requirement imposes conditions on the command languages and their modes of interactive recognition that will have a definite effect on their future evolution.

Collaboration support, and people support services

A generally overlooked but very important impact of these new computer-communication technologies will be a radical enhancement of the means for close collaboration between geographically separated workers.

Shared-access files and electronic mail (including electronic document transfer) have already been recognized, and their use will increase. Special conventions and tool features associated with file-item addressing will also grow to help the collaborative process—e.g. so that I can send you a message to "look at the paragraph (Plan-Draft-3, Sect-2, Para-5)," and your reading tool can directly access the cited paragraph in my "Plan-Draft" file when you point to the citation in your received message.

Almost completely overlooked is the possibility for "Shared-Screen Conferencing," which can readily be provided with this emergent technology. Here, when talking to one or more others on the telephone, you would optionally be able to have your respective VDT screens be inter-linked in such a way that for instance all conferees could simultaneously watch the screen dynamics as generated for the terminal of one of your members. For instance, you could all be looking at the same views of a draft plan, exchanging verbal comments, deciding on the changes that the controlling worker could then make for all to observe and verify. And the capability to control the tool (and resulting shared view) could be passed around among you—rather like passing the chalk and eraser around among a group at the blackboard.

It is reasonably apparent that such closer modes of work can evolve if such conferencing modes can be set up and exercised quickly and flexibly among those within an organization who already work together.

As an organizations knowledge workers come to do more and more of their work on line, such conferencing modes will provide increasingly valuable opportunities for close collaboration. It will be an issue in the evolution of our work culture to see if that opportunity is explored openly, in pursuit of potentially significant increases in capability. I happen to believe that a much tighter collaborative network is the only possible way we humans can cope with problems as complex and urgent as those we face today (not to speak of tomorrow's problems, where complexity and pace of events will probably increase exponentially, and when we must begin facing up to the consequences of our past blind actions).

But we should also note that these provisions for closer coupling of the work materials, and of the actual working processes between distant workers, will spawn a new degree and prevalence of specialty "people services" which the knowledge worker will be able to access via his terminal and the workshop.

These will include the professional services of secretaries, lawyers, accountants, and many other consultants found in today's world, who will increasingly move "on line" both for doing their work, and for delivering an increasing amount of their services via computer networks and VDTs.

Other types of extensive and highly specialized professional services will be delivered this way. For example, consultation and coaching services to a worker in the application of special tool systems, where the worker would be the tool user. And a potentially very large area, where the server people will apply their special tools and substantive-topic knowledge to do parts of your work for you, using tools, methods and knowledge beyond your sphere of capability—e.g., document design and typography, tool building and modifying, data base design and administration, cataloging, special-retrieval formulation, etc.

The marketplace for human services should become much more diverse and active; and this characteristic of the knowledge-work marketplace will have its special affect upon the architecture of the whole workshop.

Cost decreasing, capabilities increasing

This is a well known trend, apparent to us all. Its significance here is the challenge it presents to the architecture of the Tool System. The new capabilities should flow into the Tool System without subjecting the co-evolving Human System to indiscriminate discontinuities. (It is a very expensive matter to make abrupt, signifi-

cant changes in workers' terminology, command languages, interaction principles, work methods, skills, etc.)

Range of workstations and symbol representations

The range of workstations available to the user will rapidly increase in scope and capability. These workstations will support text with large, open-ended character sets, color graphics of increasing resolution, recorded voice, synthesized voice, video images, etc. Our tools will extend their capabilities so as to harness the workstation capabilities. For instance, we can expect before long to see increased use of dynamically changing images as a basic mode for portraying some of our working information—i.e. "movies" as standard forms of illustration.

The workstations distributed among the workers in a large organization will probably span the spectrum in cost and quality. An important challenge to the architecture of the Tool System is to be to interface to this variety of workstations in such a way as to be able to supply each type with all of the services that it can handle—i.e. so that there will be a way for the workers at lesser-equipped terminals to be able to get as much as possible in the way of services and information from tools and data whose full-blown utilization was designed for more extensively equipped terminals.

Practical economics, yes, and perhaps also some democratic principles—but there is a direct reason for requiring the above feature that will be voiced strongly by many of the workers whose offices are equipped with high-performance terminals: they will very much want to access their work from home, or from an airplane or hotel when they are travelling, where they will be limited to lower-performance terminals and yet will want to employ their tools and get at their work material as effectively as possible.

WORKSHOP ARCHITECTURE

To provide a specific example of a Tool-System architechture that was driven by the foregoing principles and assumptions, this section outlines the general architectural features implemented in Tymshare's Augment system.

Basic organization of the architecture

The over-all architectural approach that we adopted has four major components, as illustrated by Figure 7 and summarized below.

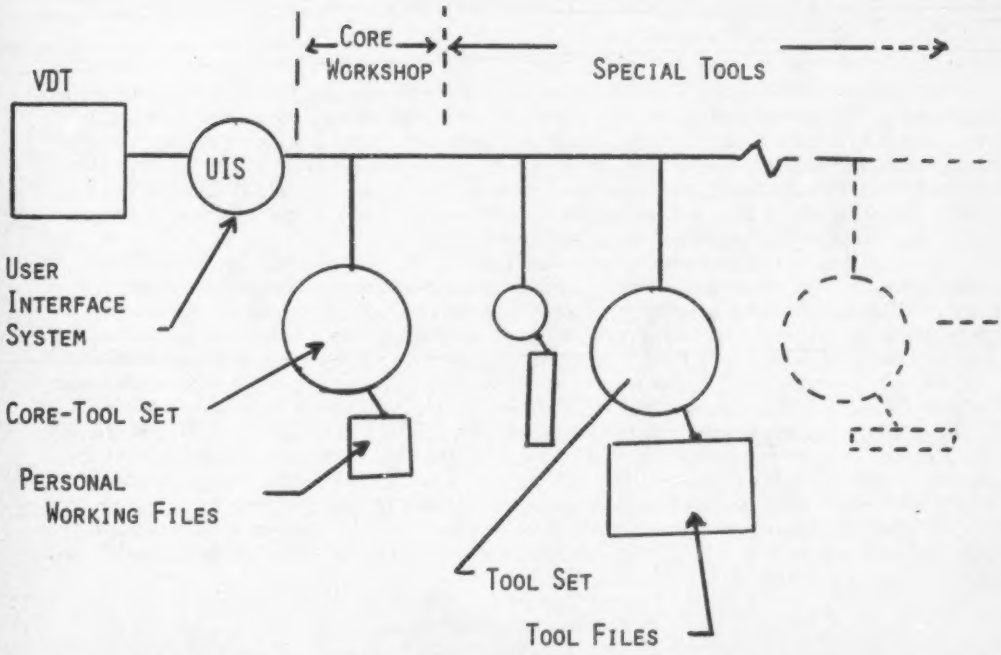

FIGURE 7.—Overview of an architecture to provide for coherent integration of many tools and services into "individualized workshops". Circular elements are software packages (of different sizes); rectangular-element file collections often have different structural characteristics; and interconnection paths are generalized representations of the network interconnections. There is no indication implied as to which if any of the programs or files are located in the terminal and which may reside on servers or hosts "out in the network".

1. A User Interface System (UIS)—to handle the interface between the user's terminal and the interactive programs. (References [7] and [8] provide a detailed description of the implementation and utilization of the UIS.)

The UIS takes care of all command-language dialog and all connection protocols. It also provides a uniform interface between the tool and the terminal to ensure that the use will (as nearly as possible) get the same treatment on a variety of terminals.

It interacts with an individual's user-profile file, to provide interface styles tailored to the needs and preferences of that individual.

It provides a reach-through service to other application systems (tools): there are special UIS features to facilitate the connection to and interaction with programs which may be written in other languages, or are running on other types of computers and/or under other operating systems. In such reach-through operation, the UIS can optionally translate between the command language of the foreign-program modules and an independently specified command language designed to meet the particular needs of the user for whom this particular UIS is being set up. A set of commands for this user, to be translated appropriately for evoking their required services from a number of different "foreign" systems, can be designed for mutal consistency, to provide an important coherence in language and function.

It provides an adaptation to different terminal characteristics, allowing users to access their work from different terminals, and enabling application programmers to develop their software as though it were to serve a virtual terminal.

The UIS also provides special access support for a Help Tool (which in our system resides in our Core Workshop). A general-purpose Help command will provide information about any term employed in the command vocabulary—extending into suggested alternatives and application tips.

What the UIS does for the Help system that is special may be employed when a worker has partially specified a command and doesn't understand some of the command terms in the feedback information or in the proffered alternatives. By strik-

ing a special Help key (or, optionally, a special control code), the worker is automatically sent by the UIS into the Help data base at a point consistent with the context of the partially constructed command.

2. A Procedure-Call Protocol (PCP)—to provide for effective communication between processes on the network. (Reference [9] gives a detailed treatment of this "PCP approach".)

This protocol makes possible the implementation in each host of an application-independent, network run-time environment making remote resources accessible at the functional level—essentially as though via a procedure call within a one-host application system. It greatly enhances the application programmer's flexibility; makes remote resources usefully accessible to other programs (not just to human users); significantly eases the problems of evolutionary changes within the network; and immensely improves the flexibility with which tools and services can be provided to the user.

3. A Core Workshop—a basic collection of tools and services that a knowledge worker generally needs, almost independent of professional specialty.

The core functions are directly analogous to what most knowledge workers do in their traditional "office place," in which one has a familiar, consistent and effective environment to do most of his editing, studying, information management, mail management, etc., and from which one conducts much of his working communications. The Augment Backend was designed to provide these core functions.

The model in the user's mind is that he does most of his work here, and will "reach through" this "home workshop" to access other tools and services. With this approach, there is special payoff for developing especially flexible and powerful capabilities in this core workshop, where the user will spend a large proportion of his on-line time and can steadily acquire more of the available techniques toward higher performance.

4. Other Special Tools—with their own file conventions operating systems, etc.

A rich and ever-growing mix of data bases, application programs and special services will want to be "reachable" in a coherent manner by ever-more of the knowledge workers in a larger organization—especially the higher-capability workers.

The general case, to be expected and possibly encouraged, will find a variety of different hardware elements (terminals, personal computers, minis and large main frames, etc.) and mix of software (different vintages, vendors, file conventions, terminology, user languages, help conventions, etc.).

It is important to support the evolutionary integration of these services into coherent, composite tools systems. This architecture enables application-support programmers easily to provide customized mixes of function and command terminology for special classes of users—even for an individual user.

Elements of the user interface system

In Figure 8 are shown the main software modules and support files involved when the User Interface System supports a user's access to a tool that is adapted for direct, "procedure call" service. The user's substantive focus is in working on information in the Backend files, employing the tool functions programmed into the support module and the special subsystem module, via commands whose specifications are facilitated by the UIS and executed via calls to the Backend.

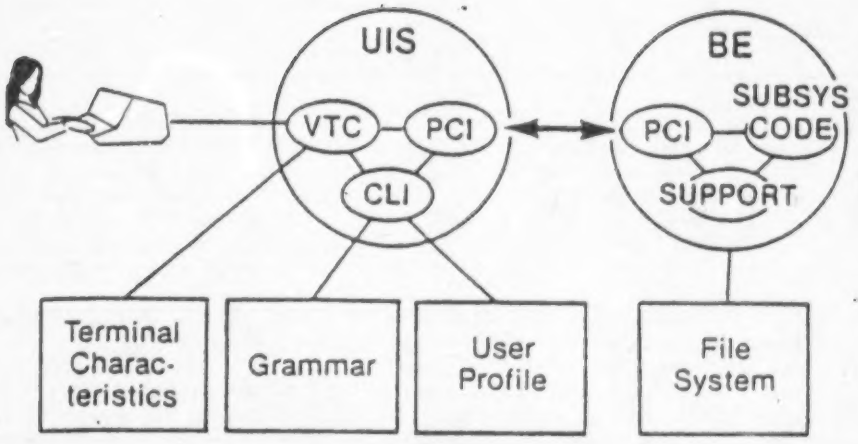

FIGURE 8.—The user Interface System (UIS) is here shown interfacing the user to a tool "Back End" (BE), using the Procedure Call Protocol for UIS-to-BE communication. The User Interface System (UIS) here employs three special software modules (elliptic elements) and three special control files (rectangular elements).

The main UIS module is the Command Language Interpreter (CLI), interpreting each action by the user and responding with screen-action feedback or calls to the Backend tools for service, according to the particular Command Language in effect.

There are likely to be many UIS-Grammar files lying around, each being a compact, specially coded specification of a particular Command Language. When attached to the CLI, a particular Grammar file determines the command terms and the feedback on the terminal screen, as well as the service-call and data-transfer interaction with the Backend tools.

For any given user, there will be one User Profile file attached to the UIS to specify the particular set of options which that user desires in the action of the CLI—e.g. style of command recognition, amount and type of feedback, formatting defaults, initialization status, escape-code assignments to particular keys, etc.

It is an administrative decision whether or not a particular user is provided with commands for changing his profile file.

The Virtual Terminal Controller (VTC) module lets the rest of the UIS operate as though serving a standard, "virtual" terminal, translating back and forth to/from the signals of whatever "actual" terminal is connected.

The characteristics of the particular terminal are packed into the special "Terminal Characteristic" file—one such for each different type of terminal that may be interfaced. For most of the modern terminals, this file is selected and installed automatically from interactions between the UIS and the terminal.

The UIS Process Communication Interface (PCI) allows the CLI to interact with the Backend tools—making service requests and receiving the results—as though it were making sub-routine calls in a "virtual" application-system environment.

In the general case, the UIS PCI would translate the UIS signals back and forth to/from a "universal procedure-call protocol" suitable for network interchange; a particular Backend tool (application system) would employ a version of the PCI that translates in turn back and forth to/from that tool's internally employed procedure-call protocol.

Note that the AUGMENT Backend, designed to provide the essential core-workshop functions, can work with full capability when separated from the UIS by a network connection. This is true for any application system that has a procedure-call interface, regardless of the programming language and run-time environment, providing a suitable PCI module is implemented in its host computer to translate between the PCP "messages" and the particular procedure-call protocol for that application system.

Foreign-system reach-through

Figure 9 shows the special provision for reaching through to "foreign" systems that do not provide a procedure-call interface—i.e. systems that can only be utilized by character-stream I/O as from a terminal. The Reach-Through Interface is a spe-

cial UIS module that can be programmed for the specific character-steam interactions of a given tool to elicit from the tool the equivalent results as expected by each procedure call sent out from the CLI.

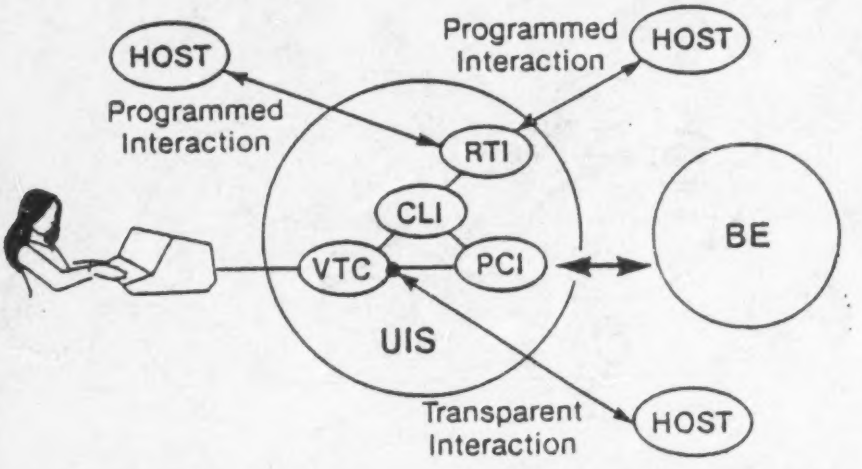

FIGURE 9.—When interacting with a backend tool not equipped for procedure-call interaction, the UIS can employ either programmed interaction via its Reach-Through Interface (RTI), or provide the user with a direct, transparent connection.

In such a case, the UIS can interact with the foreign tool as though it (the UIS) were a terminal—where the RTI is effectively translating between a CLI procedure call-return and the flow of characters back and forth to/from the tool, to call for service and to receive the results.

More than one special foreign tool can be thusly engaged at any one time; in fact, one user command can elicit a series of interactions from a number of different foreign tools, as well as from the Core-Workshop backend.

This "programmed-interaction" reach-through mode provides for an effective translation between the command language of that foreign tool and the UIS Command Language—where the latter may be designed with verbs and nouns etc. to fit the special usage and to be compatible with the rest of the grammar, vocabulary, and conceptual-model characteristics designed to serve this class of users as their coherent knowledge workshop.

This enables the coherent integration of older, main-fame application systems, many of which will live on for years.

As an alternative mode of interacting with a foreign system through its terminal I/O, the UIS can connect the foreign-system link directly to the Virtual Terminal Controller (VTC) to provide interaction as though the UIS were "transparent."

Shared-screen conferencing

In its usual employment, this conferencing mode is used in conjunction with simultaneous telepone dialog. It will work between any workers employing compatible UIS modules which may be connected by a network path. (Reference [10] gives a fairly complete description of an earlier form of this "shared-screen teleconferencing.")

This mode is established in response to a suitable set of commands by the participants, and in principle any number of users can simultaneously have such interconnections made between their UIS modules.

Figures 10 shows the resulting interconnections between the respective UIS modules of two users, A and B, who have thus established this conferencing mode. The activity of User B's CLI, PCI and Backend modules have been put on "hold." His keyboard is dead. As before, his display gets its image directly from his VTC module, but now the flow of display-creation instruction for his VTC module arrive

over the newly established conferencing link from User A's UIS module (travelling through the network, if their UIS modules are running on different machines).

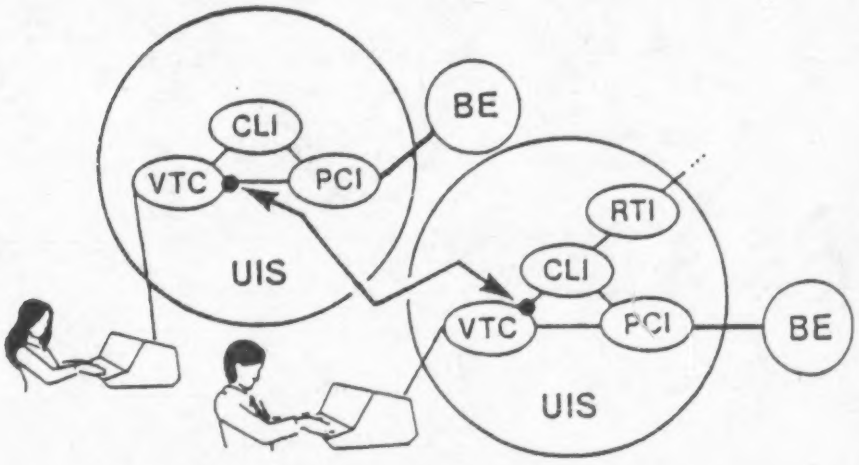

FIGURE 10.—When employing their respective UIS's in the shared-screen conferencing connection, two or more users can collaborate closely on whatever job the "showing user" has going. They can be working at any geographical separation, as long as there is a network pathway that their UIS modules can employ for the interconnecting conference link.

Both the A and B VTC modules are thus receiving the same flow of virtual-terminal display instructions, which are being evoked from whatever tools and interactions currently engaged by User A. Each VTC module converts the common, virtual-terminal screen instructions to the correct form for its connected terminal, so that this shared-screen conferencing may be used with dissimilar terminals.

In this example, both are viewing the screen image that User A was getting from her interactions with Backend A. User B is disconnected from Backend B while he is in this shared-screen conferencing mode. Nominally, they will see exactly the same image. If they have the same terminal types, the images will be exactly the same; with different types of terminals, their respective images will be as nearly alike as the VTC modules can manage.

At her option, User A can pass control to User B. Thereafter, what their "shared screen" image shows is the effects of commands from User B's terminal upon User A's active tools and files.

One worker can, in real time, thus show the dynamic workings of his screen to any number of others—no matter what command language and tool system he is using, and with a flexible range of terminal types among the conferees.

ABOUT THE WHOLE AUGMENTATION SYSTEM

Introduction

The foregoing treatment on Tool-System architecture presented a set of features designed to support the need from the Human-System side for flexible co-evolution. Any group of workers can be provided with an independently evolving, "custom workshop" having its unique configuration of functions extracted from any of the tools distributed about the network. These workers can access this workshop via different (even changing) terminals, and from distributed locations. E.g. as for a set of tools to support every sales-office manager. And the command language of this particular workshop could be tailored for its targeted class of workers.

New processors, faster network connections, new terminals, improved tools, etc., all can be integrated into the whole system without unnecessary trauma to the workers—each such change can be incorporated by improvements that involve a minimum of change in what the user has to know or in the skills he must master.

And from the Tool-System side, such an architecture enables the changes to be planned and inaugurated with a minimum number of critical coordination problems.

Augmentation-system architects, a new role

To my mind, successful harnessing of the emergent, revolutionary technologies toward full-payoff knowledge-work capabilities will require the development of a new professional discipline—to fill a role that I have been for some years calling an "Augmentation System Architect".

Such a role may emerge from an existing discipline, for instance from Industrial Engineering or from "Organization and Methods" (European style).

The Architect would be responsible for the over-all design of the Augmentation System—both the Human and the Tool components. In this role, the Architect would be:

A designer of tool configurations—selecting functional features from a catalog (hardware or software), or negotiating with hardware or seftwa :e people to provide special features;

A designer of human-system configurations—working methods, command languages, work-material organization;

Knowledgeable about relevant human factors and technology characteristics.

Note that this Architect would not be expected to be a computer programmer—any more than a building-architect is expected to be a structural engineer or a heating-and-ventilating engineer. It would be very useful to be an ex-programmer, from the point of having better understanding of the possibilities that could be negotiated with software suppliers. But most programmers would need thorough re-indoctrination in order to wear an Architect's hat properly.

Special attention to pursuit of high capability

As explained early in this chapter, I happen to believe that this new technology offers a very large increase in man's capability for handling heavy knowledge work.

From two full decades of observing relevant behavior within representative research, development, vendor and user organizations, I have isolated one particular factor which I believe will most seriously limit society's chances of pursuing this high-capability augmentation.

The liminting factor is the perception of potential payoff with which people approach the tasks of research, development, production, marketing, acquiring or applying the New Tools.

What I speak of here is the spectrum of improvements in the capabilities of people who are equipped and trained with a concerted effort toward maximizing these capabilities. Why not pull out the stops regarding equipment, training, special work methods, work concepts and language, etc., and condition and train some knowledge workers with a similar purposefulness and intensity as we would expect to condition and train a team of high-capability rock climbers, or basketball players, or race-car drivers, or sail-boat racers?

In analogy, I view the activity to date, regarding boosting our knowledge-worker capability, as about like being totally pre-occupied with prettier motor-scooters, when the potential exists for creating vehicles that could combine the performance features of racing cars, helicopters, jeeps, submarines, snowmobiles, balloons, jet intercepters, etc.—while equipping them with all sorts of sensors and navigating aids, and with special means for moving, processing, and fabricating materials.

It occurs to me that if a modest proportion of the resources being spent on what might be called the mass market were set aside toward exploratory pursuit of the high-capability end, then we would all learn more about the potential payoff.

It would make sense from my viewpoint to aim for a balanced distribution among the knowledge workers in an organization, in terms of the level of knowledge-work capability targeted for different roles. In this view then a certain proportion of research, development and implementation investment should be made toward making really significant improvements. This would involve special attention for such roles, over both the Tool System and the Human System.

The most effective strategy that I can think of, toward developing the perception and acceptance of "progress" in the Human System, is to invest in pursuit of truly high capability for selected knowledge-work roles. The best roles for this purpose would be those that would expose important stakeholders to the experience of truly high capability, by being there when that high capability is being exercised on activities relevant to their workaday world.

As a general strategy then, we might aim for specially equipped and trained teams to be connected into the workshop networks of large organizations, to perform roles that lend themselves best to early pursuit of especially high capabilities,

and where there would be an appropriate visibility, identification, and sense of relevance for the organization's trend setters.

Many features of the Tool-System architecture described above were motivated by the projected need to support a growing number of high-capability workers within an environment where their extend capabilities could effectively be harnessed by the rest of their organization (or by their knowledge-work marketplace).

CONCLUSIONS

We can reasonably hypothesize that a startling degree of improvement may be obtained in the capability level of knowledge organizations and their individual knowledge workers. And further, that in order to obtain this we must attend to changes in both the Tool System and the Human System.

If this hypothesis were to be proven valid, it would be of immense importance for a problems-laden society to have acted on it. It doesn't seem that we would have to risk much to test it out over the next decade. A very small proportion of what is being invested in the "easy to learn" level of Office Automation, if explicitly directed toward pursuing high-capability augmentation, would have a notable effect.

Features of Tool-System architecture such as described above seem necessary anyway to support the natural evolution of Office Automation, even without any special emphasis upon high-capability workers. A salient point is that these features also can support the accelerated evolution of individuals and groups, who can still work effectively with the rest of the organization, but where through their own efforts or through planned investment by the larger organization they have extended more rapidly than the rest the balanced development of their augmentation system—tools, methods, skills, etc.

And what is also important about these Tool-System features is that they provide for the harmonious co-existence, within the same organizational environment, of knowledge workers of all levels of capability. The high-capability organization of the next decade must make do with many degrees of aspiration, talent and training, and must accommodate a wide spectrum in its workers' capability levels.

And it is also important to note that architectural characteristics of the organization's knowledge workshop will have a notable effect upon the rate of co-evolution that can be achieved.

ACKNOWLEDGEMENTS

The concepts and the system described above have evolved over more than two decades, greatly aided by the research sponsorship of a number of organizations. Until 1978, at SRI International, research sponsorship by The Air Force Office of Scientific Research provided three years of critical conceptualization and planning support, from '59 through '62; DARPA's Information Processing Techniques Office, NASA, and the Air Force RADC contributed significantly until 1987, when SRI sold its rights to the system to Tymshare, Inc. There, while bringing it into the commercial market, the company has supported further conceptual and development work. During this more than two decades, probably a hundred different people have contributed directly, very significantly affecting the architecture and its implementation, and continually enriching my understanding of the "augmentation process" and its potential for improvement.

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Attachment II

Executive Summary

Purpose: The underlying purpose behind this study is to develop a suitable methodology for establishing the architecture of the Intelligence Information System (IIS) of the 1990s. This report presents the results of Tymshare's study toward that purpose, under RADC Contract No. F30602-80-C-0260.

SCOPE: The scope of this particular study was oriented to capitalize upon twenty years of R&D on interactive systems for supporting professional knowledge workers—leading to very advanced forms of "office automation" or "office information" systems.

The most relevant expertise seemed to bear upon what can best be described as "high-performance knowledge work." Equating "knowledge" with "applied information," we can directly fit analysts and decision makers into the definition of a "knowledge worker"—a person whose results depend upon the APPLICATION of information. In our prior work, the author and his associates have developed a considerable body of technique and experience in the pursuit of exceptional capability for knowledge workers through the augmentation of their tools, methods, training etc.—especially through the application of the new computer and communications technologies.

The study assumes that the physical IIS will be a network-based assemblage of host computers, data bases, application packages, inter-network gateways, intelligent terminals, etc. It is further assumed that a spectrum of solid technologies will be employed, some of which will be much advanced over today's—BUT, none of the basic recommendations of this study depends upon speculated future technologies.

The scope of this study is concentrated upon the special features of future methodology that will provide in general for practical evolution, and in particular for the evolution of tools, methods and roles that will best facilitate the aggregate evolution of the high-performance potential of the IIS.

Framework: The framework for this study isolates seven categories of system elements which will unavoidably change as the new technologies increase their penetration into the knowledge workers' workplace (into their "augmented knowledge workshop"). For summary purposes here, we may condense this list into two basic categories:

1. the physical component of the IIS—hardware, software, workstations, communications etc. that comprise the workshop's "tools"; and
2. the human component of the IIS—methods, skills, workshop knowledge, workshop language, user training, and organizational structure among the IIS users and customers.

Contrary to popular concept, the second category, the human component, is the more challenging of the two. It is also comparatively neglected in today's excitement over the capabilities of the emergent technology; yet the really significant gains in human performance will depend heavily upon innovations in this area. Over the forthcoming years of rapid change, the evolution of this human component of the IIS will probably absorb more attention and more resources than will the physical part.

Another Framework item is worth noting here: the major experimentation associated with the human-component evolution will have to take place under real-world, pilot-application conditions, out there in the working-organizations' environment.

Besides providing the only practical "R&D laboratory" in many cases, such pilot operations can provide an often-essential element of experience to people who will have key roles in guiding, buying, designing, managing or using the down-stream innovations of the IIS—in either or both the physical or human components.

The motivations, proposals and decisions for any of us depend a good deal upon elements of intuition and judgment that often go unacknowledged. When important characteristics of the future world are different from what we experienced during the formation of our intuitions and judgments, there is a surprising drop in future-planning effectiveness.

Within this framework, therefore, the "methodology" for IIS architecture must pay considerable attention to this human component of the system, and to the support for and strategic deployment of a continuing series of pilot-application installations.

The Architecture of the Physical IIS: To sensibly accommodate the continuing, rapid technological changes, the physical-system architecture needs to provide for continuing evolution at many levels. E.g., new and different host computers, data-base systems, communication links, application packages, workstations, etc. will emerge and provide very valuable incremental capability to an IIS whose architecture and operation can accommodate piece-wise evolution in a practical manner.

The contribution of our study toward this end is a recommendation for three special components of physical-system architecture:

1. A Procedure-Call Protocol (PCP). This would be a higher-level protocol to provide a standard way for two-way, over-the-net interactions between programs. The idea is to provide for all of the necessary interchanges utilized for instance within any large application system for (a) one program to call another (i.e. calling a procedure or sub-routine), passing any necessary information to the sub-routine, and (b) for the called sub-routine to return its results.

With a standard PCP established within a multi-host network, and with the appropriate translation modules installed in each host computer, a Fortran program can for instance use its own, standard sub-routine calling mechanism to make a call through these modules to some other application program that may for instance be written in PL 1. Furthermore, these two programs may be running on different kinds of computers, where the operating systems and run-time environments may be much different.

Implementing such a protocol would provide a very significant boost to the facility for application programmers to make use of other existing resources in the network-coupled system—to call on the functional capabilities of other software and the information within other data-base systems. The working life of existing software and data bases can be much extended. And in general, evolution becomes much facilitated—the phasing in and out of new and old hardware, software, and data bases can in a practical manner be more gradual and less traumatic.

2. A User Interface System (UIS). This is a software module designed not to do substantive work for a user, but rather to mediate in a standard and uniform manner between the user's terminal I/O (keyboard, display, printer) and any application program that does do substantive work for him.

For the user, the UIS provides such basic and general support as command recognition and translation, automatic connection to various types of "help" service, individualized user-option specification of control characters, formats, command-recognition style, etc., multiple-window control, multi-host communication-setup support that is transparent (to an authorized user), and so forth.

For the application programmer, the UIS also provides considerable help for developing and modifying the command languages for any and all applications, giving him powerful development tools and a flexible and standardized, engineering-like approach.

For any given command language, designed for a specific user (or class of users), the UIS can translate to/from either (a) the procedure-call (programming) interface of some application programs, or (b) the actual command-exchange stream for other application programs whose services must be elicited as though from a terminal. In either case, the UIS can provide composite services, from any mix of support programs and data bases, while providing the user with a uniform, consistent command language and set of interaction conventions that can be tailored to his needs and capabilities.

Also, the application programmer may develop his applications as for a "virtual terminal", since within the UIS there is a separate, one-time task of implementing the descriptive data table so that the UIS Virtual Terminal Interface module will properly interface with each different type of terminal. The UIS also provides standardized support for managing multiple display windows.

The UIS also provides a special, real-time "conferencing" feature. Any two users, operating from any types of terminals, connected to compatible UIS modules located anywhere in the network, can use this feature. Upon mutual agreement, their UIS

modules will establish a network link between them and switch the "viewing user's" screen to contain the same material as does the "showing user's" screen.

They thus "share" a common, dynamic view of the latter's ongoing work, which can involve data and processing from any mix of the accessible services. Control can be passed back and forth; and many workers, located at widely separated places, can be included in this "shared-screen conferencing." When combined with simultaneous voice dialog via the telephone or intercom, this mode of collaboration is very effective.

3. A Core Workshop. This is a basic set of computer tools designed to support the everyday, "core" tasks of a knowledge worker. The idea is that there be one set of tools and conventions for the worker to use for any and all of the writing, editing, note-taking, studying, online mailing, publishing, etc. An analogy may be made to a worker's office, which provides him with a similar "core" set of support capabilities.

Considerable advantage accrues when the whole, computerized workshop is organized so that the worker does all of his core work in this one environment, which can be specially tailored for the faster interactions and modest-sized data bases associated with a personal work place. And when he elicits support from other, specialized tools, or interacts with large or specialized data bases, he does so by "reaching through" his core workshop.

I.e., any preparatory work is done with his familiar tools, within his every-day working records and files. Also any consequent results from these other services are brought back into this environment for study and possible integration with other text, tables, graphics etc., and then may be published and/or distributed to other via "electronic mail."

Actually the tool kit and special conventions to support this category of basic work can grow quite large when a significant level of performance is pursued.

These descriptions and recommendations stem from over fifteen years of directly applicable development and experimentation, involving perhaps 150 man-years. These three recommended elements have all been implemented; indeed, they have been through a number of cycles of implementation, use, and re-design. From this background and experience there is a very strong and sure endorsement as to the payoff from this approach—payoff which is directly relevant and highly important within the framework of the IIS.

Architectural Methodology for the Human IIS Component: This methodology is oriented around the needs and possibilities for long-term pursuit of very high performance for the IIS-supported organizations.

The elements of physical-system architecture outlined above would be important for supporting a normal, "pragmatic" evolution in both the physical and the human components of the system. Their presence would also make possible an added methodological element—one that fosters and supports a parallel, explicit pursuit of very high performance.

In particular, assume that such as the Procedure Call Protocol were implemented as a not-very-expensive add-on to what otherwise will be in the expected IIS network. Assume further that the recommended User Interface System and the Core Workshop may also be employed, for their payoff in general functional capability and evolutionary support. But whether or not this is the case—if there is a reasonable multi-host network environment, and the PCP can be implemented, then the following becomes practical.

Special, prototype hardware-software modules, containing these UIS and Core-Workshop components, can be attached to an existing IIS network. Many features may be included in such a module to support an especially high level of user performance. Basic principles and examples of such features are described in the body of the report.

A major theme here is the role and payoff value for developing and employing knowledge-worker teams of especially high performance capabilities within IIS-associated organizations.

There seems to be a basic set of "special, high-performance applications" whose active pursuit could provide effective, leading-edge exploration within a systems-evolution methodology. The most basic of this sort of application, for a set of advanced IIS capabilities, would be to equip "high-performance augmented support teams" (HPASTs).

Provided with special tools, backed with souped-up computer service and higher-quality work stations, and given extended training in the operation and application of all of this, such a team would be aimed at providing direct, interactive support to untrained or lesser-trained people.

An HPAST could supply services and results unavailable in any other way, and would provide important experience in achieving exceptional knowledge-work performance for individuals, small teams, and general organizational units.

To give explicit focus while initially learning what tools and skills to include and how to assemble and train a team, it will be necessary to have an end-target application in a real-life environment (assumedly within an IIS-user organization, toward satisfying Item 1 above). From studying basic team-role requirements in candidate applications there evolved several basic, team capabilities that should get earliest attention toward achieving high performance:

Capabilities for each team member for high performance at basic knowledge-work tasks (entry, editing, studying, organizing, formatting, indexing, locating, etc.) over a complex and detailed domain comprised of free text, tables, graphics, messages, documents, notes, transcripts, etc.

A capability for team members to work in close, highly interactive collaboration among themselves (all of them being specially equipped and trained for this).

A capability for team members to work in close, highly interactive collaboration with other people. (There are several important classes of "other people," but it is assumed generally here that these can be people who are not trained to operate the system, but who may be watching displays or projection screens whose images are being manipulated by the high-performance support people—and generally there would be voice interaction between the supported people and the support staff.)

A team capability for doing a very basic set of knowledge-work tasks that is identified as "integration, analysis, and portrayal." These would be the basic, knowledge-work tasks involved in producing a situation briefing from a varied collection of inputs—or, in producing a handbook; or in summarizing a de-briefing session; or in summarizing the current status of a conference.

Some best-candidate end-target applications were established, for employing prototype high-performance support teams within intelligence-related organizations. [In reading the items listed below, consider that the support team would be able to produce direct, interactive results on the screens of the supported people with much more speed and flexibility than is generally thought possible.]

1. Supporting ongoing conferences of various sorts, or mixes thereof—concurrently gathered, proximate conferences; concurrent teleconferences; time- or space-distributed teleconferences.

2. Supporting the community of groups involved in a large project. Many details in the complete picture; but briefly, to support:

   collaborative communications (conferencing, computer mail, document distribution and control);

   development and maintenance of a "project intelligence collection"—the internal records, messages, memoranda, draft versions of requirements and specifications etc. as well as the commentary applied thereto—plus collections of relevant external information.

   integration (from the intelligence collection), clean-up, organization, updating etc. of a "Project Handbook".

3. Supporting basic, ongoing activities of a software-development group.

A team, of from five to ten people, can serve as a prototype organizational model with which we can experiment with much higher levels of specialty skills and knowledge, and where we can work out effective modes of high-performance collaboration and new organizational roles. Conscious evolution in the whole-system character of a team can be carried out far more quickly and economically than with larger organizational units.

There are a number of explicit possibilities for a physical hardware-software assemblage with which to equip those high-performance support teams. The Tymshare Augment System (direct successor of the SRI NLS System) was developed with the above goals in mind, and already employs advanced implementations of the Procedure Call Protocol, User Interface System, and Core Workshop. Many provisions are already there to support high performance.

As described in the report, extensions in a number of dimensions are ready to be made. For instance, integrating digitized voice into the existing environment, with compatible provisions for high-performance storing, organizing, editing, citing and locating; the same for concurrent video; highly flexible ways to address and explicitly cite selected passages from text, graphic diagrams, recorded voice strings, or stored video frames; integration of advanced analytical tools; integration of extremely fast and flexible, small-base, relational data management facilities—all of these when integrated and applied by highly trained experts offer capabilities the world has never before seen.

It is very important to note that this general methodology, for implementing high-performance teams and employing them within IIS-relevant organizations could and should get under way immediately.

As IIS-related people would thus gain experience with possibilities and payoffs, many improvements in the approach could be considerd: e.g. fancier technology, more-concerted pursuit of high individual performance, special attention to high levels of team coordination, better designs of organizational roles for the high-performance teams, etc.

It is important to begin producing examples and gaining experience.

PREPARED STATEMENT OF DR. AN WANG, PRESIDENT AND CHAIRMAN, WANG LABORATORIES, INC.

Mr. Chairman and, through you, to the members of this Committee:

The information processing industry has become the focus of increased national attention over the past few years. We note the tremendous growth of computer usage in the business world by making predictions of even more widespread implementation through this decade. One major consulting firm expects that by 1990 between forty and fifty percent of all American workers will make daily use of some 38 million computer-based workstations. Another consulting firm estimates American investments in office systems will reach more than $35 billion per year by 1990.

Accompanying these impressive figures are enthusiastic scenarios of the so-called "office of the future" in which various technologies merge, not only to boost the productivity of our expanding white-collar workforce, but to enrich our work experience and promote unprecedented job satisfaction.

Certainly, we have made great strides in the development of office systems technology since the 1950's and 1960's when the first large computer were installed in government facilities, and major corporations. Computers were seen as a way to obtain management control over the volumes of information generated throughout companies in a high-growth economy. Simply stated, these computers were nothing more than huge, stand-alone calculators. Local terminals operated under the strict constraints of a massive central computer which was controlled by data processing specialists. Because computers could accomplish only a few steps of a complex informiation handling process, management had to shape people's tasks to meet the needs of the computer.

In a 1965 report to Congress, NASA outlined the importance and appropriateness of manned space flight by celebrating the efficiency of its astronauts. One lighthearted statement reads, "Man is the lowest cost, 150-pound, nonlinear all purpose computer system that can be mass produced by unskilled labor." This statement was invalidated by the relatively recent development of the microcircuit chip, a miniscule sliver of glass and metallic components, which replaced the hot vacuum tubes and thousands of transistors that powered early computers. Today's smaller, faster and more affordable computers bring a 100,000-fold increase of computer capability over the former room-sized computers. The result of these technological advances is the availability of sophisticated yet easy to use office systems for the people who actually need, create, use and share information. In other word, we believe that machines must work for people and respond to our work habits.

Given our pressing need for increased productivity in our workforce, we should be encouraged by these advances. Yet we should temper our enthusiasm for the coming "electronic workplace" with a careful assessment of exactly what we hope to accomplish through improved technology, and we must guard against facile approaches to office system implementations.

It is on this issue that we urge your committee and the Senate to proceed with the same pragmatic care, realism and commitment to people and their needs that are exercised when the Senate considers new legislation. Today, we are witnessing the birth of an information civilization, characterized by the creation and distribution of information and knowledge. Realizing the promise of this new age will depend on a rising level of human productivity and character and on our ability to create, use, and manage information properly.

To ask what are the applications of the computer is like asking what are the applications of electricity. This comparison is apt because like electricity, the ability to store, access, manipulate, transmit, and share information almost instantaneously is a form of power, allowing us a greater degree of control over our environment.

Technology provides the tools to help us enhance, organize, and put our abilities to use. The technology is here—and yet, technology is not enough. If we fail to be expert problem-seekers, if we fail to produce orderly and meaningful solutions, and if we fail to understand that technology is a powerful resource that must be professionally managed, then the concept of "office automation" will remain just that, a concept, instead of a reality. I hope that your committee will take this opportunity to not only improve your office systems, but to consider the potential impact of technology on our changing society and the critical productivity issues we face today.

We define office automation as people using technology to manage and communicate information effectively in and between offices. Our major strategy at Wang is focused on automating individual departments or offices within the overall organization, for it is in the individual department that we can best quantify and qualify specific tasks, needs, objectives and worker habits.

Today we recognize a need to move information easily from one location to another; to receive, compile and interpret high-quality reports with information from both larger centralized computers and autonomous departmental systems; to do projects better as well as faster; to keep morale high; to provide more responsive services to constitutents or clients; to give the taxpayer more for the dollar, and the consumer a better product.

Information is acquired, managed, and communicated in four principal forms: numbers, words, images, and voice. More and more frequently, a given office task uses two or more forms of information. For example, information from a telephone call may be added to a textural memo that also includes data in both numerical and graphic form. So, we at Wang believe that people need access to the technologies of data processing, word processing, image processing, and audio processing in a single system that is versatile enough to handle and integrate—where needed—all forms of information, all of the time, and at the same time. The communications backbone of that system is known as networking.

No responsible vendor will suggest that an organization immediately implement a total office automation system. Technology should be introduced gradually by first assessing the needs of individual offices, work groups, or departments, and by conducting a site survey for the successful placement of systems. The careful assessment of needs may show that some offices should begin with a small word processing system. Workers in other offices may express a more urgent need for data processing and a telecommunications linkage to a centralized computer. A few offices may welcome the integration of all of the above capabilities, plus personal computing. Whatever technology is introduced, it is imperative that acquired systems have the capability to expand as needs grow. Moreover, all acquired systems should be compatible for eventual inter-office communications and information sharing.

In time, the offices of the Senate should have at least the same capability to deal with necessary information as the modern offices of small businesses which presently benefit from small, integrated word processing/data processing systems. It may be useful to select one Senate office with heavy data and word processing needs for the testing of a model system. In this case, we recommend the introduction of an office systems pilot program to include an expandable minicomputer offering the complete integration of data and word procesing. Flexible software programs on this decentralized system would offer data processing for office budgeting, accounting, and financial modeling via electronic spread sheets; and word processing for basic correspondence needs and the rapid creation and revision of reports and studies. Additional capabilities would include personal calendar management and electronic messaging.

The system must include capacious information storage, document filing, and document retrieving capabilities. Additional software programs, as easy to use as basic word processing, would provide advanced document and information filing and retrieving through the system's own data base technolocy.

This system must be able to support industry-standard telecommunications protocols in order to access centralized data bases wihin the organization, and useful online data bases such as those offered by Reuters, the Library of Congress, and The New York Times.

Output devices would include a daisy printer for letter-quality printing, and if desired, a matrix printer for draft-quality printing.

The system must be capable of accommodating several workstations that guide the user through easy to follow "prompts" and "menus" for function selection.

System security is also an issue for many users. Therefore, the selected system must include multi-level security safeguards to ensure the integrity of selected information.

Finally, the selected vendor must be able to provide highly responsive customer engineering, training, and support.

The need for enhanced personal productivity has led to a growing use of small personal computers. Today we see several large organizations suffering from a proliferation of personal computers that exist independently of both local systems and centralized computers. If personal computers are desired, we suggest the implementation of those that are capable of interacting with the larger system, and which also provide the same range and depth of office automation functions available on standard workstations.

Thus, a completely integrated system will make available a host of functions from a single workstation. This workstation will function independently for word processing and personal computing; it will join a small network of workstations for the sharing of information; and it will participate in a larger network including a main data processing facility, specialized data bases, and other systems comprised of minicomputers.

The question has been asked: "What new developments in office automation can we anticipate over the next two to five years?" Office automation made its early strides by providing basic data and worked processing capabilities for secretaries and clerical workers. Today we see increased usage among professionals and managers. Tomorrow we will find workstations tailored to meet the specific needs of upper-level executives. We can expect advances in voice processing for speech recognition and in image processing for the easier creation and transmission of graphics.

But in truth, inventions cannot be predicted with pinpoint accuracy. And even if we could predict their appearance, we would still face the task of determining their impact on our business procedures and our way of life. The increased usage of office systems over the next few years will depend, not as much on new developments in technology, as on a growing awareness of what these new tools can help us accomplish. The technology is here. So are the reams of productivity studies documenting time and money savings through the proper use of technology.

By implementing the technology available today, United States Senators of tomorrow can look forward to more efficient control over their office budgets and accounting procedures. They can anticipate the more effective use of personnel through improved text creation, revision, and distribution of position papers, testimony, press releases, and speeches. Information will be readily accessible and presentable, leading to more effective decision making. Senate staffs will be freed from the constraints of a centralized computer, while using centralized information in a more timely fashion. Moreover, your state offices will also use the same system to review legislation in progress and your position on various bills, as well as to share information on interest groups and constituents.

Yesterday's worker asked, "How can I get my hands on more information? Inundated with information, today's worker often asks, "What can I do with all of this information? How can I manage it? And is it the information I truly need?" For it is not merely enough to increase the flow of information if our objectives are unformed or unrealistic. It does not matter how many computers we plug into our wall sockets if we fail to recognize that we seek to improve, not only the quality and movement of information, but, more importantly, the use of human resources.

It does not matter that we communicate faster and more affordably than ever before—if we continue to communicate the same old message.

It does not matter that we plan our businesses and manage our resources by computer—if the computer only allows us to make the same mistakes more quickly.

And it does not matter that technology can provide us with new services and products—if we cannot apply them to the critical, individual needs of people in the office.

With office automation, we can be encouraged to take full responsibility for our personal productivity and that of our staffs. I eagerly await the example you will set for our nation's offices. The promise of increased productivity is real—but we need to come to terms with change and to cultivate a full understanding of how technology can help us meet our national and private goals.